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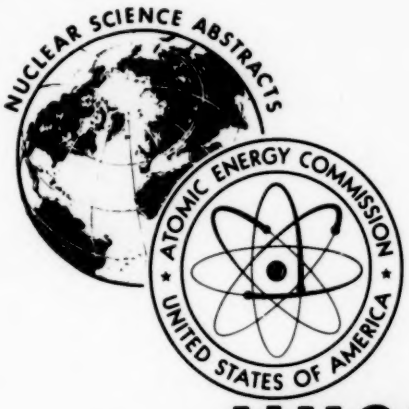

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Volume 19, Number 2, January 31, 1965

NUCLEAR SCIENCE ABSTRACTS

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NUCLEAR SCIENCE ABSTRACTS

BIOLOGY AND MEDICINE

General

1988 (EUR.1836.e) NUCLEOCYTOPLASMIC RELATIONS IN THE OOCYTE. Adrienne Ficq (Brussels. Université). 1964. 16p. (CONF-732-1). Dep.(mn).

From Symposium on the Structure, Chemistry, and Functions of Chromosomes, Istanbul, July 1963.

Nucleic acid and protein metabolism and nucleocytoplasmic relations in growing oocytes were studied by autoradiography. No incorporation of ^{3}H-thymidine could be detected in the DNA of lampbrush chromosomes during oogenesis. On the other hand, when experimental techniques are adapted to preserve molecules of low molecular weight, some thymidine incorporation is observed in mature oocytes at the cytoplasmic level. RNA, rapidly and intensely labeled by ^{3}H-uridine, ^{3}H-cytidine, or ^{14}C-adenine was localized in the germinal vesicle. Conversely, s-RNA, which seemed characteristic of a transfer-RNA, is principally localized in the cytoplasm. The ribosomal RNA, very abundant in oocytes became progressively inactive during the course of their growth. There was considerable protein synthesis linked to particles rich in RNA in these cells. A peak in this synthesis was observed at the onset of vitellogenesis. Experiments lead to certain hypotheses concerning the nature of the nuclear RNA which is rapidly labeled and in close contact with the lampbrush chromosomes. This RNA could be of an informational type and play a role during the early embryonic development, in the protein synthesis concomitant with the cleavage of the egg. (auth)

1989 (ORNL-3700) BIOLOGY DIVISION SEMIANNUAL PROGRESS REPORT FOR THE PERIOD ENDING AUGUST 15, 1964. (Oak Ridge National Lab., Tenn.). Nov. 1964. Contract W-7405-eng-26. 197p. Dep.(mn); $5.00(cy) OTS.

Separate abstracts were prepared on twenty sections of this report. A list is included of 362 contributions to open literature during the period covered by this report. (C.H.)

For abstracts of individual sections see: 1990, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, and 2164.

1990 (ORNL-3700(p.173-5)) MICROBIOLOGY. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies on the effect of near-ultraviolet radiation on electron transport in Streptococcus faecalis; studies on lactic-malic transhydrogenase; and the preparation of monosubstituted naphthoquinone from Streptococcus faecalis. (C.H.)

1991 INVESTIGATION OF ^{32}P BREMSSTRAHLUNG WITH A SCINTILLATION β-SPECTROMETER. V. I. Lapchenkov (Central Medical Radiology Research Inst., Ministry of Health, Leningrad). Biophysics (USSR) (English Transl.), 8: No. 1, 134-42(1963). Translated from Biofizika, 8: No. 1, 117-22(1963).

The conditions of origin of internal and external bremsstrahlung were considered. The theoretical formulas were experimentally checked for the intensity of bremsstrahlung appearing in bone, Al, Fe, Cu, and Pb. Information on bremsstrahlung in soft tissues was also obtained. (auth)

1992 CIRCADIAN MITOTIC RHYTHM IN EPIPHYSEAL CARTILAGE. David J. Simmons (Argonne National Lab., Ill.). Nature, 202: 906-7(May 30, 1964).

The percentage chondrocytes undergoing mitosis (mitotic index) in the proliferating zones of distal growth cartilages was calculated in femurs of mice maintained for two weeks at a photoperiod of 12 hr (0900 to 2100) alternating with 12 hr of darkness (2100 to 0900). Maximum mitotic activity was noted at 1800, an index greater than the means of groups reported from 1000 to 1400 and from 2200 to 1000. (H.M.G.)

1993 INTERNATIONAL ASSOCIATION OF THEORETICAL AND APPLIED LIMNOLOGY. PROCEEDINGS. VOLUME XV. CONGRESS IN MADISON, WISCONSIN, AUGUST 20-5, 1962. T. T. Macan, ed. Verhandl. Intern. Ver. Theoret. Angew. Limnol., 15: 1-1148, (1964). Stuttgart, E. Schweizerbart'sche Verlagsbuchhandlung, 1964.

One hundred fifty papers were presented. Separate abstracts were prepared for four. (H.M.G.)

For abstracts of individual papers see: 1998, 2058, 2059, and 2547.

1994 COPPER AND PEROXIDES IN RADIOBIOLOGY AND MEDICINE. Jack Schubert. Springfield, Illinois, Charles C. Thomas, 1964. 225p. $9.00.

Needs of the chemist, biologist, and physician are considered in a critical review of current knowledge in copper chemistry, copper in biochemistry and medicine, and peroxides and copper oxidases in radiobiology. Special emphasis is given to: theories of radioprotection; formulation of the Cu(I,II)–peroxy mechanisms of radiobiological action; protection by cyanide and nitriles; protection by sulfhydryl compounds; protection by carbon monoxide, nitric oxide, reducing agents, and amines; protection by modification in environment or physiological and metabolic state; radiation sensitization; chemical treatment postirradiation and against neutrons; and comparative radiosensitivity of animal organisms and tissues. (H.M.G.)

Ecology

1995 (TID-21302) RATE AND PATTERN OF MOVEMENT OF VARIOUS RADIOISOTOPES IN A CENTRAL MESOPHYTIC FOREST; ALLEE MEMORIAL WOODS, PARKE COUNTY, INDIANA. Robert Petty and Eliot C. Williams, Jr. (Wabash Coll., Crawfordsville. Ind.).

Apr. 15, 1963. Contract AT(11-1)-1006. 84p. Dep.(mn); $3.00(cy), 2(mn) OTS.

Progress is reported in studies of the rate of movement of ^{134}Cs and ^{85}Sr in a forest ecosystem after inoculation into young trees of a central mesophytic forest in Parke County, Indiana. Data are reported on the ecology of the 3 reference areas in relation to the regional forest complex, terrestrial mineral cycling, microclimatic variables, litter characteristics, litter fauna, and bacteria and fungi populations, and soil characteristics. The distribution of ^{134}Cs in four tree species, precipitation leaching from tagged foliage, the secondary uptake of ^{134}Cs by surrounding vegetation, and the release of ^{134}Cs from decaying leaves are discussed. Data are appended on the natural radioactivity levels in the study areas and phytosociological characteristics of woody species in the 3 reference areas. 35 references. (C.H.)

1996 THE RADIOACTIVITY OF VIVIPARUS ATER, CRIST. AND JAN, FRESHWATER MOLLUSC, IN RELATION TO THAT OF THE SEDIMENT. Oscar Ravera (CCR-EURATOM, Ispra, Italy). Foederation Europaeischer Gewaesserschutz, Informationsbl., No. 10, 61-5(May 1964).

An attempt was made to determine the relation between the radioactivity of a benthonic organism (Viviparus ater, Crist. and Jan) and the sediment. Studies were made to determine if in different granulometric fractions of lake sediment there were also different concentrations of the most common radioisotopes from fallout: ^{137}Cs, ^{95}Zr–^{95}Nb, ^{103}Ru, ^{104}Ru, ^{105}Ru, ^{106}Ru, and ^{144}Ce. It was found that the concentration of each radioisotope is different in the different fractions and that there was no correlation between the level of radioactivity and the size of the particles. The water used in sieving did not lead out radioisotopes from the sediment. The excretion rate, the granulometric characteristics of its food, and the feeding and assimilation rate were determined for Viviparus using ^{85}Sr as a tracer. Viviparus were found to feed on the finest part of the sediment and, therefore, the radioactivity of the smallest particles is important. The mollusks seemed to concentrate radiostrontium from the sediment in its shell and embryos and the greatest part of radioruthenium in its excretement. (M.C.G.)

1997 VARIABILITY OF THE STRONTIUM-90 AND CAESIUM-137 BURDEN OF NATIVE PLANTS AND ANIMALS. L. L. Eberhardt (General Electric Co., Richland, Wash.). Nature, 204: 238-40(Oct. 17, 1964). (HW-SA-3535)

Cesium-137 and ^{90}Sr body burdens were determined in plants and animals at selected sites in Alaska, Idaho, Nevada, Utah, California, and Maryland, and coefficients of variations were derived. Coefficients of variation for burdens of ^{90}Sr and ^{137}Cs were surprisingly consistent over a wide range of plants and animals. Values for ^{90}Sr ranged from about 0.30 to 0.45, while those for ^{137}Cs appeared somewhat lower, ranging roughly from 0.25 to 0.35. Various factors possibly affecting individual sets of data are indicated. With one exception (Maryland white-tailed deer), the bone–strontium-90 values were calculated in terms of picocuries (10^{-12} c) per g calcium (strontium units). Analysis of the Alaskan caribou data in terms of picocuries per g standard dry weight yields virtually the same coefficient of variation. The plant data were calculated on the standard dry weight basis, while soil-levels were on a unit area basis. All ^{137}Cs values were expressed in units per g dry weight. Results reported here should not be interpreted as meaning that the coefficient of variation for levels of these two radionuclides is everywhere roughly constant. (H.M.G.)

1998 CONTRIBUTIONS OF RADIONUCLIDES TO OUR UNDERSTANDING OF AQUATIC ECOSYSTEMS. Allyn H. Seymour (Univ. of Washington, Seattle). Verhandl. Intern. Ver. Theoret. Angew. Limnol., 15: 227-36(1964).

Radionuclide studies of aquatic ecosystems involving water circulation, bottom sediments, fish tagging, cycling of chemical elements, and productivity are discussed. It is pointed out that the greatest single use of radionuclides for the study of aquatic ecosystems is the use of ^{14}C to measure primary productivity. Advantages and limitations of radionuclide methods and factors related to the biological accumulation of radionuclides are reviewed. (H.M.G.)

1999 LABORATORY TRAINING MANUAL ON THE USE OF ISOTOPES AND RADIATION IN SOIL-PLANT RELATIONS RESEARCH. A Joint Undertaking by the International Atomic Energy and the Food and Agriculture Organization of the United Nations. Technical Reports Series No. 29. (International Atomic Energy Agency, Vienna). 1964. 176p. $3.50; Sch 73,50; 21s. stg; F. fr. 14,–; DM 12,25 (IAEA).

General information and laboratory exercises on the properties of radiations and the use of radioactive tracers and detailed exercises in the fields of soil-plant relationships are presented. (H.M.G.)

Metabolism, Tissue Distribution, and Toxicology

Refer also to abstract 2360.

2000 (BNL-7463) STUDIES ON MYELOCYTIC CELL TURNOVER IN BONE MARROW AND BLOOD. T. M. Fliedner, E. P. Cronkite, and V. P. Bond (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract AT(30-2)-Gen-16. 25p. (CONF-807-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Symposium on Use of Isotopes in Hematology, Freidburg, i.B., Mar. 1962.

The availability of radioactive isotopes, newer biochemical methods, and their combination with cytological methods has introduced new approaches for study of many aspects of the physiology and pathophysiology of myelopoiesis. Tritiated thymidine has been used in the human being to study the kinetics of cellular proliferation of the myelopoiesis in the marrow and the kinetics of the blood granulocytic turnover by combining autoradiography with cytological cell identification. Serious difficulties in the interpretation of the bone marrow data arise through the difficulties to correlate morphological cell compartments with proliferative cell compartments. An approach is described to characterize at least the last proliferative compartment of the myelopoiesis capable of cell division. The sequence of appearance of labeled mature myelopoietic cells in bone marrow and blood is described for normal hemopoiesis, for bacterial infection, and various disorders of myelopoiesis. In one case, a markedly delayed release time was found. The difficulties of interpretation of such data are discussed. (auth)

2001 (BNL-8471) PROTEIN SYNTHESIS AND CELLS OF THE SKELETAL SYSTEM. Edgar A. Tonna (Brookhaven National Lab., Upton, N. Y.). [1964]. Contract AT-30-2-GEN-16. 46p. (CONF-786-1). Dep.(mn); $2.00(cy), 1(mn) OTS.

From Symposium on Use of Radioautography in Investigating Protein Synthesis, Montreal, Sept. 1964.

A series of autoradiographic studies of the femurs of mice 5 to 52 weeks of age using ^{3}H-glycine, ^{3}H-proline, and ^{3}H-histidine is described. These studies included the assessment of cellular uptake, utilization, and turnover of ^{3}H-amino acids in matrical protein precursor formation. Four skeletal cell populations were compared; namely, those of the osteogenic layer of the periosteum, metaphyseal-endosteal-osteoblasts, and cartilage cells of the epiphyseal plate and articular surfaces. Fracture studies are described in an attempt to assess the protein synthetic potential of cells at different ages. Micrometric measurements were also made to determine the protein synthetic activity present at various bone surfaces. In addition, the degree of ^{3}H-amino acid reutilization was estimated from the autoradiographs. (auth)

2002 (ORNL-3700(p.63-8)) CYTOCHEMISTRY AND CELL REPRODUCTION. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies of the effects of 5-aminoacridine on mutation frequencies during mitotic reproduction in yeast; the enzymatic and antigenic properties of the proteins produced by mutations of Neurospora; electron microscopic studies of chromosomes of Drosophila buskii, and the synthesis of RNA in Tetrahymena. (C.H.)

2003 (ORNL-3700(p.89-94)) RADIATION IMMUNOLOGY. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies of methods for the enrichment of cells involved in antibody formation; the incidence of natural agglutinins and the primary antibody-forming potential of chick embryos and young chickens of various ages; the effect of erythropoietin on the antibody response of plethorized mice; the competition of antigens for progenitors of antibody-forming cells in mice; the suppressive role of peritoneal phagocytes in agglutinin response; and reaction mechanisms involved in antibody synthesis. (C.H.)

2004 (ORNL-3700(p.127-33)) CO-CARCINOGENESIS. (Oak Ridge National Lab., Tenn.).

I. Using 10% Tween 80 as the solvent, clear aqueous solutions of 3,4-benzpyrene may be acquired up to 700 μg/ml. Foaming of cultures may be minimized by using an air jet above the surface of the growth medium rather than the customary bubbling. Incorporation of benzpyrene in the liquid medium caused no inhibition above that slight inhibition due to the solvent, Tween 80. Tritiated benzpyrene was used for uptake measurements. Aerobacter aerogenes and Bacillus megatherium were tested. Neither mutation nor hydrocarbon uptake was observed. II. The phenotypic classes of thymine-deficient bacteria under investigation and their interrelationships have led to surmises as to the associated genetic loci. Certainly there is a gene controlling thymidylate synthetase formation. There is at least one gene controlling thymine uptake. Recall the conversion of the inefficient thymine uptaker, t23, to an efficient uptaker, t23B, by a method that one would suppose selects spontaneous mutants. Further, it is likely that at least one more gene is involved, since the similar t23B and 15T yield revertants very dissimilar. Obviously, from the demonstrated and proposed steps in thymine utilization by various cells, one can anticipate a certain minimum number of controlling genes. What is referred to in this report are those functions which are represented by available mutants. A genetic study was begun where the various thymine markers described herein are to be inserted into suitable polyauxotrophs of E. coli K12 recipient bacteria. Also, currently under way are assays for nucleoside transdeoxyribosidase and thymidine hydrolyase in the various classes of thymineless bacteria and during the different phases of their growth: It is possible that absence or inducibility of one of these enzymes may account for certain anomalies such as, for example, the diphasic growth of the AM-derived auxotrophs. If so, then thymine uptake may become expressible in definite biochemical terms. (auth)

2005 (ORNL-3700(p.134-47)) CELL PHYSIOLOGY. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies of viral antigens in leukemic mouse tissues; the use of continuous-flow gonal centrifugation for the isolation of virus and the preparation of rat globulin; the separation of nucleotides by capillary column chromatography; ribonucleic acid synthesis in Tetrahymena pyriformis; the water content of bacteriophage; the formation of thymine dimers in ultraviolet-irradiated aqueous thymine solutions by freezing; the development of boundary layer diffusion techniques for the determination of reagent flow rates; and development of zonal centrifuge techniques. (C.H.)

2006 (ORNL-3700(p.148-9)) NUCLEIC ACID CHEMISTRY. (Oak Ridge National Lab., Tenn.).

Progress is reported in the development of ion exchange chromatographic techniques for the separation of oligo- and polynucleotide mixtures; studies of the properties of polydeoxynucleotides, and studies on the purification and properties of Micrococcus lysodeikticus DNA polymerase. (C.H.)

2007 (ORNL-3700(p.150-4)) NUCLEIC ACID ENZYMOLOGY. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies on the biochemical transformations of bacteriophage T_2 DNA; enzymatic condensation of oligodeoxyribonucleotides; the polymerization of R17 bacteriophage RNA; interspecies aminoacyl-s RNA formation in Neurospora crassa and Escherichia coli; fractionation studies of s RNA using partition columns; studies on the structure of amphibian egg ribonucleic acid; isolation of a new enzyme, P^1, P^4-diguanosine 5′-tetraphosphate pyrophosphohydrolase from brine shrimp eggs; and studies of the purification and properties of corn root deoxyribonuclease. (C.H.)

2008 (ORNL-3700(p.157-72)) ENZYMOLOGY. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies on protein synthesis and amino acid incorporation in a number of cell-free systems prepared from Escherichia coli, Clostridium pasteurianum, rat liver, and maize; the cell-free synthesis of B-galactosidase; amino acid incorporation by extracts of Escherichia coli; amino acid incorporation by extracts from Clostridium pasteurianum; the study of soluble amino-acid-incorporating system from rat liver; the control of protein synthesis during liver regeneration; ribosome formation in rat liver; the effects of puromycin or actinomycin on protein synthesis in rat liver; antibody synthesis in cell-free systems; the isolation and purification of the isoleucine-activating enzyme from Escherichia coli; the isolation and purification of specific transfer RNA from Escherichia coli; studies on RNA polymerase from corn tissues; the effects of light on protein synthesis in plants; the properties of adenosine 5′-phosphosulfate reductase from Desulfovibrio desulfuricans; the inactivation of messenger RNA by ultraviolet radiation; hydrocortisone stimulation of nuclear RNA synthesis in rats; the effects of testosterone on RNA synthesis in rat seminal vesicle; enzyme induction in rat liver and in the Reuber hepatoma; and molecular forms of lactate dehydrogenase. (C.H.)

2009 (ORNL-3700(p.176-9)) PLANT PHYSIOLOGY AND PHOTOSYNTHESIS. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies on the effects of storage on germination of lettuce seed; initiation of root growth in wheat seedlings; the effects of gibberellin on germination of excised wheat embryos; and energy conversion during photosynthesis. (C.H.)

2010 (JPRS-27049(p.61-78)) MEASUREMENT AND SYNTHESIS OF TRITIUM-TAGGED COMPOUNDS AND THEIR APPLICATION IN PHARMACOLOGY. Cheng-yu Sung. Translated from K'o Hsueh T'ung Pao, No. 7, 607-16(July 17, 1964).

A brief description is given of the methods used to synthesize tritium-tagged pharmaceuticals, with emphasis on the tritium gas exposure method. The liquid scintillation counting method for determining tritium is also described. Some examples are given of the application of tritium-tagged compounds in pharmacological research on metabolism, regeneration, nerves, cells, and drug distribution in the body. (D.L.C.)

2011 STRONTIUM– CALCIUM INTERRELATIONSHIPS IN THE GROWING RAT. Ray F. Palmer and Roy C. Thompson (General Electric Co., Richland, Wash.). Am. J. Physiol., 207: 561-6(Sept. 1964). (HW-SA-3314)

The comparative metabolic behavior of strontium and calcium was studied in growing, female rats exposed either continuously or to single doses of ^{90}Sr and ^{45}Ca while on diets of various total calcium contents. At weaning the discrimination against ingested ^{90}Sr relative to ^{45}Ca was markedly less than that previously observed in mature rats. This discrimination increased and approached the levels observed in mature animals, while growth and ^{45}Ca deposition was still proceeding at a rapid rate. The effect of a fourfold increase in dietary calcium (from 0.5 to 2.0%) over a 200-day feeding period was a twofold reduction in the steady-state level of ^{90}Sr in bone. As previously shown in mature rats, the retention (as opposed to absorption) of a single dose of ^{90}Sr was relatively unaffected by dietary cal-

cium level, while that of ^{45}Ca varied from almost total retention on a 0.1% calcium diet to retention on a 2.0% calcium diet which was similar to that observed for ^{90}Sr on all diets. (auth)

2012 ACTION CURRENT OF STRIATED MUSCLE IN HEAVY WATER. Howard Jenerick (Emory Univ., Atlanta). Am. J. Physiol., 207: 944-6(Oct. 1964).

The propagating spike potentials of frog sartorius fibers recorded in H_2O- and D_2O-Ringer's fluids were compared. Negligible changes in the resting, spike, and afterpotential were seen. However, excitability was decreased and apparently caused a slowing of the conduction velocity. A differential effect on the inward and outward current was also observed. Whereas the inward current and conductance appeared completely independent of the solvent, the outward current was quite sensitive to D_2O. It was reasoned that such behavior was more indicative of an ion exchange process for the action current in contrast to the conventional mechanism of parallel Na and K conductances. (auth)

2013 UPTAKE AND ELIMINATION OF COBALT-60 BY CRAYFISH. C. W. Wiser and D. J. Nelson (Oak Ridge National Lab., Tenn.). Am. Midland Naturalist, 72: 181-202(July 1964).

Comparative studies of ^{60}Co uptake by living and dead crayfish (Cambarus longulus longerostris Ort.) indicated that about one-half of the accumulation was by adsorption and one-half by absorption. However, most of the absorbed ^{60}Co was deposited in the exoskeleton, and 95% of the body burden was lost at molting. Newly molted crayfish accumulated about one-half as much ^{60}Co as did individuals with hardened exoskeletons. Large animals accumulated more ^{60}Co than small ones, but the uptake per gram was greater in the small crayfish, indicating the importance of surface adsorption phenomena. Rates of accumulation, measured by biological half-times, were 70 hours for small animals and 66 hours for large animals living in a continuously renewed medium. Uptake half-times under conditions where the medium was not renewed were 24 hours for small crayfish and 16.5 hours for large ones, showing that the higher percentages of total uptake occurred more quickly when the supply of ^{60}Co was limited and with larger animals. The half-time for accumulation by dead crayfish was about three times that for live crayfish. Elimination rates were much slower than accumulation, with losses being as slow as 0.9% to 1.6% per day until ecdysis occurred. The half-time for elimination by small crayfish was 37 days and that for large crayfish 70 days, both having been dosed by exposure to radioactive solutions. Elimination by crayfish dosed by injection was more rapid, with half-times 13¾ and 19 days for low-activity and high-activity injections, respectively. Cobalt-60 occurred at low and equal levels in blood, muscle, and gonads, while higher concentrations were found in the gut, hepatopancreas, and integument. The integument contained the greatest amount per unit weight, with the hepatopancreas ranking second. (auth)

2014 THE ABSORPTION AND DISTRIBUTION OF RADIUM AND THORIUM IN RAT. E. Penna Franca, O. Gomes de Freitas, and Pedro Lopes dos Santos (Universidade do Brasil, Rio de Janeiro). Anais Acad. Brasil. Cienc., 36: 227-35(1964).

The administration to rats by different modes, of ^{228}Ra and ^{228}Th as well as their absorption, distribution and excretion were studied. The injected ^{228}Ra was fixed preferentially in bones, and eliminated mostly by fecal excretion. The intramuscular or subcutaneous administration thorium remained in the site of injection and very little excretion occurred. The intravenous injection was removed from the blood almost exclusively by the liver and spleen. Soluble thorium administered by stomach tube was practically non-absorbed from the gastrointestinal tract. When rats were kept for 45 days on a diet containing 10% finely ground monazite sand, no increase in the radioactivity of the tissues was observed. It is concluded that adventitious ingestion of monazite sand is not an important process in the possible internal contamination, by heavy radionuclides, of men living in monazite sand areas. (auth)

2015 PHYSIOLOGICAL AND MUTAGENIC EFFECT OF D_2O ON DROSOPHILA MELANOGASTER. V. G. Tumanian and S. E. Shnol' (Moscow State Univ.). Biophysics (USSR) (English Transl.), 8: No. 1, 13-16(1963). Translated from Biofizika, 8: No. 1, 15-18(1963).

The experiments carried out do not confirm (in the concentration range of D_2O investigated) that uniform isotopic composition of hereditary material is essential. The increased rate of dominant lethals on crossing deuterized females with nondeuterized males can apparently be attributed to isotope replacement in the cytoplasm of the ovum. Experiments with recessive and dominant lethals showed the absence of a mutagenic effect of D_2O or of deuteric substitution in Drosophila for the concentrations investigated. The literature provides some information on the mutagenic effect of D_2O detected in bacteriophage. This might be due to the indirect, mediated effect of heavy water. In a special experiment results were obtained supporting the idea of additivity of the effects of D_2O and ionizing radiations. (auth)

2016 THE BEHAVIOR OF RADIUM IN PLANTS. P. P. Vavilov, O. N. Popova, and R. P. Kodaneva (Inst. of Biology, Komi Branch of the Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 157: 992-4 (Aug. 1, 1964). (In Russian)

Cabbage plants (Brassica oleracea L., var. acephala) were grown on soil artificially enriched in Ra to 1×10^{-7}%. After 35 days, part of the plants were analyzed for the Ra content in the leaves. The soil was carefully removed from another group of plants that were transplanted to "clean" soil having a normal radium content. A month later these plants were also subjected to radiochemical analysis. The Ra content was determined according to the distance of the leaf from the root. The Ra content in leaves of the 7th to 9th layers was 5.60 and 6.64×10^{-12} g per 1 g of dry material respectively. The young leaves of the 14th to 15th layers showed a low Ra content of 1.40×10^{-12} g per 1 g of dry substance. The maximum absolute content of Ra was found in the most mature leaves of the 9th to 12th layers. These data indicated that the flow of Ra is regulated completely by growth processes of the plant leaves. On being transplanted to "clean" soil, the radiochemical data indicated that the radium remains fixed in the plant. However, the Ra content in the leaves is decreased due to the increase in the biomass of the plant. (TTT)

2017 THE BIOLOGICAL HALF-LIFE OF TRITIATED WATER IN THE MOUSE, RAT, GUINEA-PIG AND RABBIT UNDER TROPICAL CONDITIONS AND THE EFFECT OF CLIMATE AND SALINE DRINKING ON THE BIOLOGICAL HALF-LIFE OF TRITIATED WATER IN THE RAT. J. M. Foy (Nigerian Coll. of Tech., Ibadan, Nigeria). J. Cellular Comp. Physiol., 64: 279-82(Oct. 1964).

Body water turnover (the biological half life of tritium, $T_{\frac{1}{2}}$) was determined in the rabbit, guinea-pig, rat and mouse under tropical conditions. The $T_{\frac{1}{2}}$ value increased progressively (except for the rabbit) with body size. The $T_{\frac{1}{2}}$ value of the rat showed little variation with changes in climatic condition, for instance tropical shade, air-conditioned room and cold-room; significant differences were only recorded between the air-conditioned and the cold-room. In all conditions animals drinking 0.9% saline solutions had a quicker water turnover. (auth)

2018 ESTIMATION OF DIETARY INTAKE OF STRONTIUM-90 FROM EXCRETA ANALYSIS. Minoru Fujita (Japan Atomic Energy Research Inst., Tokyo). J. Nucl. Sci. Technol. (Tokyo), 1: 255-63(Oct. 1964).

Methods to evaluate the levels of ^{90}Sr in diet from the amounts in excreta were investigated by measuring the levels of ^{90}Sr due to fallout and the contents of stable calcium in diet and excreta. Samples were obtained from 4 volunteers for 7 periods of 5 days each. From the data ob-

tained, strontium–calcium observed ratio, (O.R. (urine/diet), and O.R. (feces/diet)) were calculated. The mean value of O.R. (urine/diet), 0.32, obtained was smaller than those reported by others (0.48 and 0.73). However, the mean value of O.R. (feces/diet), 1.32, was in agreement with the reported 1.56. On the other hand, with regard to the ratio of the amount of ^{90}Sr in feces to that in diet, the mean value obtained, 0.67, agreed with the 0.86 of another. The reasons for the agreement of the O.R. (feces/diet) values and for the disagreement of the O.R. (urine/diet) values are discussed in detail, by considering the ratio of ^{90}Sr (or Ca) in excreta to that in diet. It was concluded that, in evaluating the levels of ^{90}Sr in diet from the amounts in urine or fecal samples, fecal analysis was superior to urine analysis, because the O.R. (feces/diet) as well as the ratio of the ^{90}Sr in feces to that in diet was relatively constant under various conditions. (auth)

2019 METABOLISM OF Sr^{89} FOLLOWING THE INHALATION OF LIQUID AEROSOLS OF $Sr^{89}Cl_2$ INTO MICE AND THE EFFECT OF INHALED HEXAMETAPHOSPHATE. F. Gensicke and H.-W. Nitschke (Staatliche Zentrale für Strahlenschutz, Berlin and Institut für Angewandte Isotopenforschung, Berlin). Kernenergie, 7: 629-33(Aug. 1964). (In German)

The retention, resorption, deposition, and excretion of inhaled liquid aerosols of $^{89}SrCl_2$ in mice were investigated. The results obtained show a small retention in the respiratory tract and a rapid incorporation of ^{89}Sr into the skeleton. Following a single or repeated treatment with hexametaphosphate aerosols (beginning of the treatment 24 hr after $^{89}SrCl_2$ inhalation), the activity was considerably reduced, especially in the skeleton after the second or third treatment. (auth)

2020 HIGH NITROGEN FIXATION RATES IN THE SARGASSO SEA AND THE ARABIAN SEA. Richard C. Dugdale (Univ. of Alaska, College), John J. Goering, and John H. Ryther. Limnol. Oceanog., 9: 507-10(Oct. 1964).

Nitrogen fixation rates were measured in the Sargasso Sea and the Arabian Sea using the ^{15}N method. Heavy enrichments in ^{15}N were found in a number of experiments in which the blue-green alga, Trichodesmium, was used for the experimental material. (auth)

2021 TOXICOLOGY OF INSOLUBLE ^{232}Th AND ^{238}U COMPOUNDS. E. B. Kurlyandskaya. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 3-9(1964). (In Russian)

A review is given of data presented in eleven articles on effects of thorium dioxide and uranium oxides administered intraperitoneally, intravascularly, or perorally, and on uranous–uranium oxides and their uptake, excretion, and late effects on various organs in dogs and rabbits. (R.V.J.)

2022 COMPARATIVE TOXICITY OF SOLUBLE AND INSOLUBLE ^{232}Th COMPOUNDS. Hsiao-shan Yen. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 10-18(1964). (In Russian)

Comparisons of the toxic properties of $ThCl_4$, $Th(NO_3)_4$, and ThO_2 indicated the highest toxicity for $Th(NO_3)_4$. Differences in toxicity were determined by solubility and by a higher NO_3^- toxicity than Cl^-. The low solubility of ThO_2 resulted in the lowest toxicity. (R.V.J.)

2023 ON THE ABSORPTION, DISTRIBUTION AND SECRETION OF SOME SOLUBLE COMPOUNDS OF NATURAL THORIUM. Niodrag Traikovich. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 19-27(1964). (In Russian)

Data are presented on the distribution and secretion of soluble compounds of natural thorium and thorium nitrates administered to rats by various methods. Observations indicated that in intraperitoneal, intravascular and peroral administration 53 to 75% of the accumulated thorium was found in the bone tissue, while the whole organism contained only 2% of the total volume. In intracardiac administration thorium accumulation is primarily in the liver (17%) and spleen (3%), indicating certain peculiarities in thorium distribution related to the degree of dispersion. (R.V.J.)

2024 EFFECTS OF ThO_2 ADMINISTERED INTRATRACHEALLY AND INTRAPERITONEALLY ON ORGANS OF RATS. Hsiao-shan Yen. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 28-37(1964). (In Russian)

Five days following intratracheal administration of thorium dioxide it appeared in the lungs, trachea, lymphatic glands, cervix, intestinal tract, the liver, bones, and kidneys. The largest amount was found in the lungs (63 to 73%). Twenty-one months later 15 to 30% of the thorium was still in the lungs. Lymphatic glands still contained some thorium. Excretion of thorium with the urine and feces was negligible following intratracheal administration. Intraperitoneally administered thorium oxide was retained in the abdominal cavity with 14.4 to 74.6% retained after 15 months. (R.V.J.)

2025 EFFECTS OF ThO_2 ON THE ARTERIAL PRESSURE AND STIMULATION THRESHOLD OF NEUROVASCULAR APPARATUS IN RATS. Hsiao-shen Yen. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 51-7(1964). (In Russian)

A sharp drop in the systaltic blood pressure was observed in rats subjected to intratracheal and intraperitoneal injection of 2, 20, 200, 300, 400, and 1000 mg/kg of thorium dioxide. The neurovascular apparatus of rat extremities treated with thorium dioxide showed no changes during 18 months after treatment. (R.V.J.)

2026 MORPHOLOGICAL CHANGES IN THE LUNGS AND OTHER ORGANS OF RATS FOLLOWING INTRATRACHEAL ADMINISTRATION OF ThO_2. E. S. Gaidova and Hsian-shan Yen. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 58-72(1964). (In Russian)

Single intratracheal introduction of thorium dioxide induced various changes in the lungs and parenchymal organs. The changes were in direct proportion to dose and time. Changes in the lungs were expressed by chronic bronchial empyema with sclerosis in the peribronchial tissue, pneumonia, abscesses, and adenomatotic growths. Tumors, sarcomas, and cancer developed at later dates (13 to 21 months). The liver exhibited albumen distrophy and microneurosis, while the kidneys showed epithelial dystrophy of the convoluted tubules. (R.V.J.)

2027 TOXICITY OF URANOUS–URANIC OXIDE (U_3O_8). A. A. Rubanovskaya. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 77-88(1964). (In Russian)

Studies were made of the clinical picture in chronic U_3O_8 poisoning, of uranium excretion in urine and feces, of U_3O_8 distribution, and of pathomorphological changes in organisms of treated animals. Considerable quantities of U_3O_8 (17, 33, and 100 g) introduced over 30 to 50 days into the intestinal tract of dogs did not influence the general condition. Absorption and dissolution was negligible. Histological studies indicated a small degenerative process in the kidneys, intestinal walls, and local blood circulation. Single introduction of large quantities of U_3O_8 (to 1 g) into the lungs induced heavy intoxication. Particles of U_3O_8 are efficiently eliminated through exhilation. Rabbits with 7.2 to 76.9 mg U_3O_8 in their lungs remained healthy for 5½ to 10½ months. However, morphological investigations revealed a slight degenerative process in the kidneys and a chronic interstitial process. Following heavy intoxication with U_3O_8, dogs remained outwardly healthy and even gained weight. Administration of 1 to 1.4 g of U_3O_8 under the skin of rabbits produced no toxic effects except in their kidneys. Introduction of 2.5 and 3.5g of U_3O_8 induced a severe intoxication. (R.V.J.)

2028 CHANGES IN PERIPHERAL BLOOD DURING CHRONIC AND ACUTE POISONING WITH U_3O_8. N. L. Belorodova. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 89-95(1964). (In Russian)

Peripheral blood changes induced by intratracheal and

oral administration of U_3O_8 were analyzed. Following oral administration of 100 mg/kg 5 to 6 times a week for 2 to 4 months, dogs remained in good condition. Repeated intratracheal administration (10 to 20 mg per kg weight) induced no intoxication but produced absolute lymphopenia, periodic monocytosis, and eosinophilia. A single large dose of intratracheally introduced U_3O_8 induced leukocytosis with absolute and relative lymphopenia, eosinophilia, monocytosis, and erythropoiesis depression. The disturbance in the leukopoiesis disappears comparatively fast, but erythropoiesis left pronounced effects which led to anemia. (R.V.J.)

2029 EFFECTS OF U_3O_8 ON THE ORGANISM OF PREGNANT ANIMAL AND THE FETUS. E. B. Kurlyandskaya. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 96-104(1964). (In Russian)

Studies were made of the uptake of U_3O_8 by placenta and of excretion by mammary glands. Peroral and intratracheal administration of U_3O_8 to pregnant animals resulted in uranium in the placenta and the fetal tissues. Uranium was also found in the milk of the mother and in tissues and urine of nursing offspring. Chronic administration of U_3O_8 influences childbearing and fetal development. (R.V.J.)

2030 PATHOMORPHOLOGICAL CHANGES IN ANIMAL ORGANS DURING AN ACUTE AND CHRONIC POISONING WITH U_3O_8. M. S. Tolgskaya. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 105-17(1964). (In Russian)

Pathohistological changes in internal organs of 60 animals (27 dogs, 33 rabbits) treated with uranous–uranic oxides were studied. The lifetimes of animals treated intratracheally with acute doses ranged from 4 to 20 days. The lungs of the animals showed bronchitis and various other changes. Chronic intratracheal treatment for 250 to 315 days produced U_3O_8 deposits around the bronchus. Distrophic changes in internal organs as a result of intravenous injection of U_3O_8 are less pronounced than with intratracheal administration. Chronic intratracheal and peroral intoxication with U_3O_8 for 30 to 210 days induced proliferative processes in the thyroid gland expressed as papillomatous growth of follicle epithelium and perivascular and pericellular endema in the brain with five hemorrhages and sharply expressed vacuolization and chromatolysis of cells in the thalamo-hypothalamic region. (R.V.J.)

2031 GENERATION CYCLE IN THE DUODENAL CRYPT CELLS OF GERM-FREE AND CONVENTIONAL MICE. S. Lesher, H. E. Walburg, Jr. and G. A. Sacher, Jr. (Argonne National Lab., Ill. and Oak Ridge National Lab., Tenn.). Nature, 202: 884-6(May 30, 1964).

The duration of the generation cycle of the duodenal crypt cells was compared in germ-free and conventional non-bred ICR mice injected intraperitoneally with tritiated thymidine. Mice were killed at time intervals 0.5 to 26 hr after injection. Metaphase, anaphase, and telophase mitotic figures were scored as labeled or unlabeled. The increased duration of the generation cycle in the germ-free mice was attributed to an increase in the synthesis and presynthesis stages. (H.M.G.)

2032 IMMUNOFLUORESCENT DETECTION OF PROLIFERATING HUMAN ANTIBODY-FORMING CELLS. Paul Urso and Nazareth Gengozian (Oak Ridge Inst. of Nuclear Studies, Tenn.). Nature, 203: 1391-2(Sept. 26, 1964).

Human lymph-node cells known to have the capacity to form antibody to Salmonella typhosa antigen were used to determine the proliferative capacity of the antibody-containing cells as compared with the cells in the same population which were not forming antibody. Cultivated cells were exposed both in vitro and in vivo to tritiated thymidine and subsequently stained for antibody by immunofluorescence followed by radioautography. Results indicate: that the competent human antibody-containing cells proliferate at a greater frequency than the incompetent cells during the early phases of antibody synthesis and that the rate of proliferation reduced to normal levels during the later phases of the antibody response; and that these mature antibody-containing cells are derived from precursor cells through somatic division. It was also shown that the diffusion-chamber technique in conjunction with immunofluorescent analysis is feasible for studying cellular dynamics of human antibody-forming tissue after stimulation with an antigen. (H.M.G.)

2033 RADIUM-226 IN DIET AND HUMAN BONE FROM SAN JUAN, PUERTO RICO. Naomi A. Hallden and John H. Harley (Atomic Energy Commission, New York). Nature, 204: 240-1(Oct. 17, 1964).

The relation reported here between ^{226}Ra in the diet and ^{226}Ra appearing in the bone of Puerto Ricans is particularly interesting, since the daily radium intake is a factor of three lower and the calcium intake is a factor of two lower than that of a standard Western diet. The study shows that individuals on a low-milk, low-calcium diet exhibit the same bone to diet radium–calcium ratio (O.R.) as those on a normal Western diet. The maintenance of the O.R. over such widely differing radium and calcium intakes indicates that the uptake of radium in the human skeleton may be controlled by the dietary calcium intake. (auth)

2034 TRANSLOCATION OF STRONTIUM-90 WITHIN PUMPKIN PLANT AFTER SEED AND FOLIAR CONTAMINATION. I. Y. Mostafa and A. Hassan (Atomic Energy Establishment, Cairo). Naturwissenschaften, 51: 483(1964).

The translocation of ^{90}Sr within pumpkin plants (Cucurbita pepo) was studied by soaking seeds in a carrier-free solution of $^{90}SrCl_2$ (4 μC/ml) for 3 hr or by spraying the foliage of 14-day-old plants with the same radioactive solution. The plants were allowed to grow for 9 weeks and samples collected at different growth ages. For soaked seeds the specific activity of the shoot system was almost constant from the fourth week on but the specific activity of the roots increased. After foliar contamination the total radioactivity retained in the foliage and root remained more or less constant, whereas the specific activity decreased from week to week. There was very little ^{90}Sr activity in the root. (M.C.G.)

2035 METABOLISM OF RADIONUCLIDES IN FISH. III. COMPARATIVE BEHAVIOUR OF STRONTIUM AND CALCIUM AT GILL ABSORPTION IN ENVIRONMENTAL WATER WITH DIFFERENT AMOUNT OF CALCIUM. Ryushi Ichikawa, Mikio Oguri, and Naoko Takada (National Inst. of Radiological Sciences, Chiba, Japan). Nippon Suisan Gakkaishi, 28: 1160-3(Dec. 1962).

The influence of the calcium concentration in the environmental water on the behavior of strontium and calcium at the brachial absorption of fish was investigated in a gill perfusion experiment of ^{45}Ca and ^{89}Sr using the Japanese eel, Anguilla japonica. The calcium concentrations applied in this experiment were 30 mg, 60 mg, and 190 mg per 1,000 ml of external perfusion medium. The strontium-calcium discrimination factors at the brachial absorption in these calcium concentrations were 0.71 ± 0.06, 0.66 ± 0.02, and 0.73 ± 0.03, respectively. These values resemble roughly that (0.74 ± 0.02) obtained in previous experiments using the environmental water containing 100 mg/l calcium. Accordingly, it seems that the strontium-calcium discrimination factor in the brachial absorption of fishes is approximately 0.7 and not greatly variable over the wide range of calcium concentration of the environmental water. (auth)

2036 RESULTS OF COMPARATIVE MEASUREMENTS OF CESIUM-137 INCORPORATION IN WOMEN POST-PARTUM, NEWBORN INFANTS, AND PLACENTAS. P. Koeppe, W. Harms, and U. Schneider (Freie Universität, Berlin). Nucl.-Med., 4: 127-33(Jan. 10, 1964). (In German)

The results of comparative measurement of gamma activities in women post-partum, in new born infants, and in placentae are reported. In contrast to the results of earlier measurements, the presence of the fission product ^{137}Cs was observed in infants and placentae too, in addition to ^{40}K. This difference can be explained by the assumption that a possible barrier function of the placenta against Cs

incorporation can be overcome by very high Cs levels. (auth)

2037 RADIOCHROMATOGRAPHIC INVESTIGATION OF SERUM IODINE FRACTIONS IN THYROID FUNCTION DISTURBANCES. H. Stahlbock and F. Petersen (Therapeutische Strahleninstitut des A. K. St. Georg, Hamburg). Nucl.-Med., 4: 156-71(Jan. 10, 1964).

Following a tracer dose of ^{131}I, paper chromatography was used to determine the relative serum iodine fractions 2, 4, 24, and 48 hours after administration. In 6 euthyroid patients labelled tetra- and triiodothyronine was found as early as 4 hours after administration. In 6 patients with thyrotoxicosis higher proportions of mono- and diiodotyrosine were found more frequently than in the euthyroid cases. During radioiodine therapy (10 cases) no increased excretion of tyrosines was observed. In 8 out of 10 patients controlled 3 to 18 months after radioiodine treatment increased amounts of tyrosines were found after 2 hours. The frequent occurrence of tyrosines following radioiodine-therapy can be interpreted as either a primary or secondary radiation effect (increased thyrotropic stimulation). In addition, radiochromatographic studies of the serum were made in goitrous patients suspected of faulty iodine metabolism (20 cases). In 1 case (iodine goiter) the transient disturbance of tyrosine binding to the thyronines was observed. In a second case (thyroiditis) monoiodotyrosine was greatly increased temporarily. Furthermore, 5 patients with hypothyroidism due to various causes were studied. The frequent occurrence of iodinated tyrosines and a high concentration of peptide fractions was conspicuous. (auth)

2038 THE AGE-DEPENDENCE OF STRONTIUM RETENTION IN RATS AND MICE. Thomas W. Speckman and William P. Norris (Argonne National Lab., Ill.). Radiation Res., 23: 461-74(Nov. 1964).

Rats and mice varying widely in age were given single intravenous doses of ^{85}Sr to determine the age-dependent variations in retention. Each animal was measured repeatedly in a nondestructive manner for many days after injection. After about 100 days strontium was excreted at essentially identical rates independently of age. At earlier times the effects of age were clearly evident. Mathematical treatment of the data provided over-all descriptions of strontium retention for each age group. An extension of this treatment provides for estimation of strontium retention in continually exposed animals and for calculations of the associated radiation dosages. (auth)

2039 THE VARIATION OF STRONTIUM METABOLISM WITH AGE IN THE DOG. Clarence F. Decker, Lillian V. Kaspar, and William P. Norris (Argonne National Lab., Ill.). Radiation Res., 23: 475-90(Nov. 1964).

Strontium-85 was injected intravenously into dogs of widely different ages. Maximum retention occurred in animals about 6 months old, approximately the age of puberty. The reduced retention in younger dogs was attributed to their high requirement for bone resorption to allow for growth. In dogs 6 months of age and greater, strontium retention became progressively less up to an age approaching 10 years. However, the magnitude of this difference was small in animals of ages greater than 5 years. At times less than 200 days after injection the retention behaviors were interpreted as being the resultant of heteroionic exchange, the accretion and resorption of bone necessary for growth, and reutilization of strontium returning to the blood, especially in the young, growing animals. By about 200 days after injection, however, the rates of excretion (expressed as the fraction of the body burden excreted per day) in all dogs, regardless of age, had approached the same value. This indicates that only small fractions of the strontium burden are released from bone after this period of time and by a mechanism largely independent of the age of the animal. It was not possible to differentiate between strontium removal resulting from actual resorption of bone and that caused by physical-chemical processes. However, the similarities in long-term rates of excretion were such as to suggest that physical-chemical processes may finally predominate in removing strontium from bone. The retention of strontium in dogs of various ages was described mathematically by a modified power function. The appropriate constants were evaluated for each age. This function allows more exacting estimations of strontium burdens and associated parameters than have heretofore been possible. (auth)

2040 INFLUENCE OF PHYSICOCHEMICAL STATE OF INTRAVENOUSLY ADMINISTERED POLONIUM-210 ON UPTAKE AND DISTRIBUTION. R. G. Thomas and J. N. Stannard (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 16-22(1964).

Polonium in either 0.5N HCl or 0.15M sodium citrate solution disappeared relatively slowly from the circulation in the rat after rapid intravenous injection (for example, one-half of the polonium injected remains in the circulation at 25 minutes). When administered in neutral solution of sodium chloride (0.9%), removal from the circulation was much more rapid (one-half of the polonium injected was absent from the circulation in less than 40 seconds). Injection of aged neutral solutions containing large particulates resulted in very rapid removal, whereas a freshly prepared solution containing small and/or few particulates showed a blood disappearance rate between that of the aged neutral and that seen with acid or citrate solutions. Different factors appeared to influence the kinetics of blood disappearance at later times so that at 24 hours the blood levels were appreciably higher after injection of a neutral than after injection of an acid or citrate solution. Concentrations of polonium in liver, lung, and spleen appeared to be consistently higher at 20 minutes after injection of neutral solutions than after injection of acid or citrate solutions. This is consistent with the expected role of the reticuloendothelial system in removing particulates. In the respects studied, polonium solutions behave on injection as might be expected from in vitro work with polonium and biological work with colloidal chromic phosphate and related materials. Necessity for careful control of injection solution treatment is emphasized. (auth)

2041 THE BINDING OF POLONIUM BY RED CELLS AND PLASMA PROTEINS. R. G. Thomas (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 29-39(1964).

A large fraction of the red cell and plasma polonium appears to be bound to proteinaceous material after polonium chloride is given either intravenously or orally to rats, or intravenously to the rabbit. This is true from 24 hours to at least 24 days postinjection. Hemoglobin accounts for nearly all the red cell polonium. It is bound to the globin rather than to the hemin moiety. Plasma proteins appear to share the metal according to their respective concentrations. Red cell stroma accounts for only a small amount of the total bound polonium but on a concentration basis is about equal to hemoglobin. The binding to protein appears to be nonspecific, the total being related to the relative fraction of the component present. Other blood constituents such as plasma or red cell lipids and hemin do not bind polonium to any appreciable extent. The mode of binding after 1 day does not appear to be specifically related to the nature of the original injection solution. (auth)

2042 SOME IN VITRO STUDIES OF POLONIUM-210 BINDING BY BLOOD CONSTITUENTS. I. Feldman and P. Saunor (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 40-8(1964).

The filterability of polonium in the presence of various polycarboxylic and amino acids at near blood pH was studied by using MF Millipore filter paper of 10-mμ pore diameter. It was shown that homogeneous pH adjustment, achieved by means of urea and ammonium chloride plus heat, gave much better reproducibility than was obtained by adjusting the pH of polonium solutions with droplets of sodium hydroxide. It was also found that the per cent filterability of near-neutral polonium suspensions is independent of the total polonium concentration below 2000 d/m/ml. The conclusion was drawn that in tracer concentration any polonium carried in blood in a diffusible form is probably bound about 75% to citrate and about 20% to bicarbonate,

the remaining few per cent being complexed by malate and phosphate ions. In agreement with previous in vivo studies, it was concluded further that the polonium affinity should be relatively strong for most plasma proteins, since the binding is not limited to any one functional group and should be roughly additive. A brief discussion is given relating the phenomena of radiocolloid formation, hydrolytic polymerization, and anion penetration to the chemistry of polonium in vitro and in vivo. (auth)

2043 DISTRIBUTION AND EXCRETION OF POLONIUM-210. 1. COMPARISON OF ORAL AND INTRAVENOUS ROUTES IN THE RAT. J. N. Stannard (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 49-59(1964).

Similarities and differences in the metabolism of polonium-210 were studied in rats of both sexes receiving a single gavage dose as compared with a single intravenous dose. Corrected absorption from the gut averaged 5.0% in males and 4.5% in females, the difference not being significant statistically. Urinary excretion is in general significantly higher after an oral dose. Although excretion in the feces is very high for a few days after gavage, the increased amount in urine cannot be accounted for by contamination from this source. Red blood cell contents are strikingly higher after gavage, whereas contents in kidney, spleen, bone marrow, and lymph nodes are in general lower than after intravenous administration. Other tissue concentrations remain essentially independent of route if considered in terms of the fraction of the body burden found in each gram of tissue. These differences predict significant alterations in radiation dose to the organs if tissue content is considered separate from blood content. (auth)

2044 DISTRIBUTION AND EXCRETION OF POLONIUM-210. II. THE EARLY FATE IN CATS. P. E. Morrow, F. A. Smith, R. J. Della Rosa, L. J. Casarett, and J. N. Stannard (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 60-6(1964).

Significant absorption of polonium occurs from the cat stomach, and the rate is independent of the chemical form of polonium administered. On the other hand, the rate of absorption of soluble polonium citrate from the intestine exceeds that for polonium colloid by a factor of at least 10. In the dose range 3 to 18 μC of polonium per kilogram of cat body weight, and up to 12 hours, the rate of polonium absorption from either the stomach or the intestine is proportional to the dose. The major differences in polonium distribution among organs and in the urinary excretion rates are related primarily to the route of entry. Chemical form (hydroxide or citrate) plays a secondary role once the material has entered the circulation. Autoradiography of the tissues indicates that the cellular location of this element varies qualitatively and quantitatively when the route of administration is varied, to a lesser degree with dose or form. The urinary excretion data agree with findings in the rat—namely, that the excretion of polonium is much more rapid in general after absorption from the gastrointestinal tract. The over-all clearance rate determined from blood and urine concentrations but without independent measures of glomerular filtration varied from 0.005 to 0.03 ml of whole blood per minute according to the site and form administered. (P.C.H.)

2045 DISTRIBUTION AND EXCRETION OF POLONIUM-210. III. LONG-TERM RETENTION AND DISTRIBUTION IN THE RAT. J. N. Stannard (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 67-79(1964).

The behavior of ^{210}Po in the rat over periods of a year or more after a single intravenous dose was studied. The loss of Po from various tissues and from the entire animal occurred in two phases, an early rapid phase and a later slow phase with varying durations and effective half lives in different tissues. Exponential kinetics fit the time-course data most closely in all but one instance, spleen. Retention by the entire animal can be described by a single exponential decay constant with a half life of about 60 days beginning on day 50 after injection. No single constant will describe the whole-body retention pattern between 1 and 50 days. The blood cells lose Po much more slowly than any other tissue, exhibiting a short rapid phase followed by a long slow phase with effective half life of 93 days. Spleen, kidney, liver, lung, lymph nodes, bone marrow, and bone fall into one group; testis, skeletal muscle, and heart in another; blood cells into a separate third category. Dosage level over a tenfold range has only a small effect on the distribution pattern. (P.C.H.)

2046 DISTRIBUTION AND EXCRETION OF POLONIUM-210. IV. ON A MULTIPLE-DOSE REGIMEN. J. N. Stannard and R. C. Baxter (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 80-92(1964).

Polonium metabolism was studied in rats on a multiple-dose regimen. In a small pilot experiment 6 animals were studied intensively over a 49-day period. In a large maintained-body-burden experiment using over 400 animals the tissue and body burdens were measured at times up to 900 days. Spot checks were made of excretion rates. These allow comparison with the distribution and excretion predicted from single-dose data. Excretion by animals on the multiple-dose regimen was slower at later times than predicted from single-dose work. This may reflect an increasing fraction of tightly bound polonium in the whole-body burden. The effective half life on a multiple-dose regimen was nearer 40 days than the 30 days usually found after single doses. The mean body contents at equilibrium were approximately twice the monthly dose, rather than 1.5 times as predicted from single-dose data. The pattern of tissue contents throughout the maintained-body-burden experiment was similar to that seen in the first month after a single intravenous injection. Spleen, kidney, and liver particularly remained high throughout the exposure period. The redistribution with time seen after a single dose did not occur. This might be expected, since there is never more than a month between exposures. This predicts it somewhat higher radiation dose to these organs per microcurie disintegrating in the body than after a single dose. The results show sufficient differences between multiple-dose and single-dose metabolism to make the performance of such experiments seem worth while for maximum permissible exposure calculations. Some comparison with other situations in the pharmacological literature was made. (auth)

2047 DISTRIBUTION AND EXCRETION OF POLONIUM-210. V. AUTORADIOGRAPHIC STUDY OF EFFECTS OF ROUTE OF ADMINISTRATION ON DISTRIBUTION OF POLONIUM-210. L. J. Casarett (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 93-105(1964).

Comparisons were made, autoradiographically, on the distribution of Po in the rat oral administration with comparable intravenous studies and intravenous and gastrointestinal routes of administration during short times after administration of the element to cats. Po aggregates were found in tissues after intravenous injection but not after oral administration to either the rat or the cat. Aggregates, when present, were found principally in the alveolar walls of the lungs, the Kupffer cells of the liver, and the red pulp of the spleen. Decrease in numbers and average size of aggregates occurred with decreased concentration, slower rate of administration, and addition of complexing agent (citrate). Anatomical location of aggregates was not significantly altered by these parameters. The distribution of nonaggregated Po was qualitatively the same irrespective of the route of administration and the form of Po administered. (P.C.H.)

2048 DISTRIBUTION AND EXCRETION OF POLONIUM-210. VI. AFTER INTRATRACHEAL ADMINISTRATION IN THE RAT. R. G. Thomas and J. N. Stannard (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 106-23(1964).

The distribution and excretion of polonium-210 were studied in rats receiving a soluble salt of this element by intratracheal injection (intubation). Three separate experiments were carried out: short-term distribution; long-term distribution (both after single injections); and distribution after multiple injections. The metabolism was found to differ markedly in some respects from that seen after either oral or intravenous administration. Clearance of po-

lonium from the lung (including injection site) was quite rapid and occurred largely by absorption into the blood stream. In kidney, spleen, liver, and several other visceral tissues there was an initial 10-day build-up period followed by a relatively slow loss. Over the period of the short-term single-dose experiment, 62 days, this loss was slower than after either intravenous or oral doses, and in kidney it resulted in an almost constant concentration from the twenty-fifth day to the sixty-second day. There were rather abrupt changes at later times, however. The polonium content of whole blood rose with time after 10 days on both an absolute and a relative basis, indicating a movement of the material from a tissue or tissues to blood. The calculated radiation dose to the lung in the short-term experiment period was about three times that to kidney or spleen. At longer times, it was more nearly equal in the three organs. Excretion was somewhat slower than after oral or intravenous administration. Excretion of half the injected dose required 50 to 60 days (loss by decay neglected), compared with about 45 days by the other routes. The fraction in feces was about twenty-five times that in urine during the initial period, owing presumably to material brought up from the lungs and swallowed. After the lungs have been essentially cleared, the ratio of fecal to urinary excretion remains at about 10:1, similar to that seen after intravenous administration. (P.C.H.)

2049 DISTRIBUTION AND EXCRETION OF POLONIUM-210. VII. FATE OF POLONIUM COLLOID AFTER INTRATRACHEAL ADMINISTRATION TO RABBITS. P. E. Morrow and R. J. Della Rosa (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 124-32(1964).

The elimination of polonium-210 hydroxide colloid deposited in the lower respiratory tract of rabbits by intratracheal instillation exhibited a rapid phase of a few hours' duration followed by a slower phase that was approximately exponential with time (half time 5 to 6 days). At 30 days only 1 to 2% of the administered dose remained in the lung. Polonium removed from the lung was deposited in soft tissues, with the highest concentration appearing in the kidney. Excretion was largely in the feces during the first week, but after about 9 days the urinary excretion rate exceeded that in feces by significant amounts. This appears to be a species-related phenomenon and characteristic of the rabbit. The retention half time of the administered polonium in the rabbit body was about 20 days. The only suitable index of body and lung burdens revealed was the concentration in the blood. The amount of polonium in 1 ml of blood was found to represent 0.13% (σ = 0.03) of the body burden during the 30-day period. The lung burden also appeared to bear a simple relation to the concentration in the blood according to the equation $x = 0.118e^{0.121y}$, where x is the per cent of the lung burden per milliliter of blood at time y, when y is between 1 and 30 days. Although the basic distribution of polonium in the tissues appears similar in rabbit and rat after intratracheal intubation, a significant difference exists in the excretion pattern, suggesting a difference in binding (blood) or in the renal clearance process. (auth)

2050 DISTRIBUTION AND EXCRETION OF POLONIUM-210. VIII. AFTER INHALATION BY THE RAT. H. L. Berke and A. C. DiPasqua (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 133-47(1964).

Rats were exposed in a specially designed inhalation chamber to a controlled NaCl aerosol contaminated with small amounts of ^{210}Po (3.17×10^{-6} μC/ml of air, geometric mean diameter 0.098 μ, σ_g 1.81). About 53% of the inhaled aerosol was deposited in the animal, about equally divided between the lung-trachea and the gastrointestinal tract after 5 hours' exposure. About 20% of the total ^{210}Po deposited in the respiratory tree was cleared during this time. The rate of post-exposure lung clearance was approximately exponential with time and quite rapid during the first 30 days (10-day half time), slower and less regular at the later times. The tissue distribution after inhalation was different from that observed after the intravenous, oral, or intratracheal routes of entry as seen particularly in blood and spleen. Total excretion was lower after inhalation (38%) than after intratracheal (43%) or intravenous administration (58%). An intermediate value of 7:1 was observed for the ratio of fecal to urinary ^{210}Po (intravenous = 10:1; oral = 2:1). It was concluded that the distribution and excretion of ^{210}Po in the rat after an inhalation exposure represents a balance between that observed after intratracheal injection and that after the oral route of entry and is sufficiently different from that after other routes of entry to warrant further inhalation studies. (auth)

2051 DISTRIBUTION AND EXCRETION OF POLONIUM-210. IX. DEPOSITION, RETENTION, AND FATE AFTER INHALATION BY "NOSE-ONLY" EXPOSURE, WITH NOTES ON MECHANICS OF DEPOSITION AND CLEARANCE AND COMPARISON OF ROUTES OF ADMINISTRATION. L. J. Casarett (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 148-65(1964).

Forty-four lightly anesthetized rats received polonium-210 on a sodium chloride vector aerosol with a count median diameter of 0.046 μ, and a geometric standard deviation of 2.24. The apparatus was designed to minimize contamination of the fur by permitting only the nares in a small area of the animal's snout to be exposed to the aerosol stream. In addition, the solution for aerosolization was freshly neutralized rather than in acid form. The estimated deposition was 33% of the inspired dose, divided approximately equally between upper and lower respiratory tracts. This initial deposition appeared to be lower than with the whole-body exposure technique. But since fewer animals were used in the earlier experiment, no large significance can be attached to this apparent difference between techniques. Retention time in the upper respiratory tract was short, with a clearance half time of 8 to 12 hours. Lung retention was expressed in several ways, the most precise statement yielding a half time of 17.5 days. Total body burden, beyond 2 to 3 days, fell to half its initial value in about 30 days. Tissue distribution was not significantly different from that seen by the whole-body exposure technique except for the presence of a peak in liver concentration. Lymph nodes showed considerable accumulation, with two maxima in concentration as a function of time, one probably associated with gastrointestinal tract absorption, the other with pulmonary absorption. Comparison of excretion rates and tissue distribution with oral, intravenous, and intratracheal injection permitted conclusions regarding MAC calculations. (P.C.H.)

2052 DISTRIBUTION AND EXCRETION OF POLONIUM-210. X. SPECIES COMPARISON. J. N. Stannard and F. A. Smith (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 166-74(1964).

The distribution and excretion of polonium-210 was compared in several species: mouse, rat, dog, rabbit, and man. The data were collected from various sources and required some recalculation and normalization, yet they appear consistent in broad outline. The rabbit excretes a larger percentage in urine than any other species studied (35% of the administered dose in 10 days). Fecal excretion rates do not show as large variation among the species. The tissue distribution figures show rather marked contrasts among species in biological half-time in some tissues but little difference in others. The contrasts are consistent with the differences in excretion rates. Man, in so far as the limited data permit interpretation, appears to metabolize this α-particle emitter more like the rat than any of the other species studied. (auth)

2053 DISTRIBUTION AND EXCRETION OF POLONIUM-210. XI. AUTORADIOGRAPHIC STUDIES AFTER INTRATRACHEAL ADMINISTRATION IN THE RABBIT. L. J. Casarett and P. E. Morrow (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 175-86(1964).

After intratracheal injection of polonium hydroxide radiocolloid and of polonium-tagged silver particles to rabbits, sections of major organs were taken for autoradiography. This allowed more detailed study of the distribution and clearance from the lung and other tissues for correla-

tion with the radiochemical findings. Qualitatively polonium colloid and polonium-tagged silver particles were found to have the same distribution in tissue after intratracheal administration to the rabbit. The contribution of different clearance mechanisms was different. The rate of phagocytosis and the rate and degree of entry into the lymphatic system appeared to be greater for the silver particles than for the colloid. Direct penetration of particles into the circulation (without previous phagocytosis) apparently occurred in this study, in contrast to polonium colloid inhalation in the rat. Concentration of ionic Po in the kidney cortex occurred, as with other routes of administration, but was found in more distal parts of the proximal tubules than with other species (rat and cat). Over-all patterns of distribution resemble a combination of those found after intravenous and oral routes of administration. (P.C.H.)

2054 [DISTRIBUTION AND EXCRETION OF POLONIUM-210]. XII. AUTORADIOGRAPHIC OBSERVATIONS AFTER INHALATION OF POLONIUM-210 IN RATS. L. J. Casarett (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 187-204(1964).

Autoradiographic studies were made on the microscopic distribution of Po in rats after inhalation. Emphasis was placed on observations bearing on the mechanisms by which Po colloids are removed from the lung, but the technique also supplied some information about the physical nature of the element in specific loci through intraorgan patterns of distribution and the relationship of radioactivity to specific elements of a tissue. Although particles were moved out of the parenchyma without being phagocytized at short intervals of time after deposition, virtually all material in these regions had been engulfed by about 2 to 6 hr after inhalation. This suggests that subsequent disposition of the particle is dependent solely on the fate of the engulfing cell. Observations suggest that entry into pulmonary interstitial tissue and into lymphatics is customarily preceded by phagocytosis of the particle by components of the alveolar wall. Autoradiographic comparisons suggest that toxicity of Po should not vary much with the route by which it is administered. (P.C.H.)

2055 ACUTE TOXICITY AS A FUNCTION OF ROUTE OF ADMINISTRATION. R. J. Della Rosa and J. N. Stannard (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 205-15(1964).

New data on the acute toxicity of polonium-210 are presented together with a compilation of several older studies. With median or mean survival times taken as the criterion for toxicity, reasonable consistency appears in two strains of rat, and the dog, cat, and mouse are not greatly different despite differences in metabolism of the element pointed previously. A striking finding is the tendency for the mean survival time in the rat to be related primarily to the total body burden of the animal. This occurs despite large differences in tissue distribution brought about by the use of different routes in administration. This suggests that a contribution to lethality may be made by many tissues when a soft-tissue-seeking element like polonium enters the body, and there may be no critical or target organ. The intraperitoneal route appears to be an exception to the above finding in that survival is longer and radiation effects are slower to appear when a given body burden is obtained by this route than by oral, intravenous, or intratracheal administration. No explanation can be offered for this finding if it is valid, although it appears likely that the kinetics of the radiation dose are different after intraperitoneal injection. (auth)

2056 THE SHORTENING OF LIFE SPAN BY A SINGLE INJECTION OF RADIUM, PLUTONIUM, OR POLONIUM. H. A. Blair (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 216-27(1964).

It is shown that the life-span relationship for polonium poisoning in the rat can be represented by equations applied previously to data on penetrating ionizing radiation. These equations are based on the hypothesis that radiation produces injury which is reversible in part and irreversible in part and that life shortening is a measure of the total injury, unrepaired plus irreparable existing at the time of death. Semiempirical equations derived from the same hypothesis for radium and plutonium poisoning permit easy handling of data on the rat and mouse and easy comparison of these elements with polonium. The long-term toxicities of polonium and plutonium are each about 5 compared to that of radium in the rat. (auth)

2057 FULLY DEUTERATED EUGLENA GRACILIS. S. E. Mandeville, H. L. Crespi, and J. J. Katz (Argonne National Lab., Ill.). Science, 146: 769-70(Nov. 6, 1964).

Euglena gracilis was grown in 99.4 percent D_2O on fully deuterated substrates. It is the first organism with distinct animal characteristics in which at least 99 percent of the hydrogen normally present has been replaced by deuterium. (auth)

2058 DISTRIBUTION OF Mn^{54} FROM FALL-OUT IN POPULATION OF FRESHWATER LAMELLIBRANCHS (UNIO MANCUS ELONGATULUS PFEIFFER). O. Ravera (CCR-EURATOM, Ispra, Italy). Verhandl. Intern. Ver. Theoret. Angew. Limnol., 15: 885-92(1964).

The usefulness of radionuclide analysis in the field of limnology is demonstrated by ^{54}Mn determinations in Unio mancus elongatulus. It is emphasized that by using these techniques, it is possible to evaluate the distribution of an element within a freshwater population, related to the age class and to different parts of the body of the individual. Results of an experimental study permit the following conclusions: the mean weight of the shell and of the tissues is correlated with the length of the former and with the age of the mollusk; the shell is heavier than the soft parts in young specimens, but is lighter in the older ones; ^{54}Mn concentration increases with increasing age of the animal; and a connection exists between the concentration factor for ^{54}Mn and the population structure. (H.M.G.)

2059 DEPOSITION OF STRONTIUM IN RELATION TO MORPHOLOGY OF CLAM (UNIONIDAE) SHELLS. D. J. Nelson (Oak Ridge National Lab., Tenn.). Verhandl. Intern. Ver. Theoret. Angew. Limnol., 15: 893-902(1964).

The association between shell structure and nonhomogeneous distribution of Sr in the shell was investigated. The shell structure of several species of freshwater clams is described and Sr analysis of the individual shell layers is reported. The results of the study showed a nonhomogeneous distribution of strontium in fresh-water clam (Unionidae) shells. Distribution was associated with growth and structure of the shell. Strontium concentrations in the prismatic and peripheral layers were approximately equal but the annual peripheral layers contained an average of only 77% as much strontium as did the corresponding laminar layers and were relatively constant in the annual peripheral layers. (H.M.G.)

Radiation Effects

Refer also to abstract 2863.

2060 (BNL-7596) LARGE CHROMOSOMES: THE SOMATIC AND MEIOTIC CHROMOSOMES OF AMPHIUMA. Grace M. Donnelly and A. H. Sparrow (Brookhaven National Lab., Upton, N. Y.). 1963. Contract AT(30-2)-Gen-16. 25p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The chromosomes of the salamander, Amphiuma, which are among the largest of mitotic chromosomes, prove to be uncommonly large and clear throughout the meiotic divisions. The Amphiuma chromosomes can be individually identified throughout the first and second divisions of meiosis. One bivalent, lacking chiasmata in the long arm, is particularly discernible. The somatic chromosomes, and especially the spermatocytic prophase chromosomes, are of the lampbrush type, and their relevance to chromosome structure is discussed. The large amount of DNA per cell reported for Amphiuma was seen to be a direct consequence of the presence of very large chromosomes. No visible evidence of polyteny was found. The general relation between DNA content, nuclear size, and karyotype size

is shown. The problem of radiosensitivity in terms of these parameters is discussed and it is predicted that, among the amphibians, Amphiuma will probably exhibit a high radiosensitivity. The chromosomes of Amphiuma, because of their large size and diagrammatic clarity, should prove to be a valuable tool for the experimental cytologist. (auth)

2061 (BNL-8451) OXYGEN EFFECT AND THE SELECTIVITY OF RADIOLESIONS IN THE MAMMALIAN NEURAXIS. Wolfgang Zeman (Indiana Univ., Indianapolis. Medical Center and Brookhaven National Lab., Upton, N. Y.). [1964]. Contract AT-30-2-GEN-16. 31p. (CONF-785-1). Dep.(mn); $2.00(cy), 1(mn) OTS.

From 7th Symposium on Neuroradiologicum, New York, Sept. 1964.

Selective radionecrosis of the neuraxis occurs as regional and cellular selectivity. The assumption that the oxygen effect might account for regional selectivity of radiation damage was experimentally tested on the rat spinal cord. With a threefold increase in the local oxygen tension relative sensitivity increased by a factor of about 1.15. These data indicate that regional selectivity of delayed radionecrosis of the murine spinal cord can only in part be related to the oxygen effect. (auth)

2062 (BNL-8462) CYTOGENETIC EFFICIENCY OF DIFFERENT IONIZING RADIATIONS. Harold H. Smith (Brookhaven National Lab., Upton, N. Y.). [1964]. Contract AT-30-2-GEN-16. 20p. (CONF-754-3). Dep.(mn); $1.00 (cy), 1(mn) OTS.

From International Business Machines Medical Symposium, Poughkeepsie and Upton, N. Y., Oct. 1964.

The efficiencies of monoenergetic fast neutrons, muons, and π^- mesons were compared with that of x rays in breaking chromosomes of maize seeds. The RBE's were 0.76 for muons, 3.23 for π^- mesons, and around 50 for neutrons with energies of from 0.43 to 1.80 Mev. Within the range of energies of monoenergetic neutrons used, those of lowest energy (0.43 Mev), and consequently giving paths of highest average LET (72 kev/μ), were the most efficient. On the basis of these relationships it was predictable that the meson particles (the biological effects of which are essentially untested) would give an RBE (compared to 250 kvp x rays) of less than one for muons and more than one for π^- mesons. These predictions were verified experimentally. (auth)

2063 (BNL-8469) RADIATION DAMAGE AND RECOVERY IN MAMMALIAN CELLS. Howard J. Curtis (Brookhaven National Lab., Upton, N. Y.). [1964]. Contract AT-30-2-GEN-16. 18p. (CONF-801-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Panel on the Molecular Basis of Radiosensitivity, Vienna, Nov. 1964.

Radiation effects at low dosages are due almost entirely to chromosomal damage, and in the mammal all somatic cells seem to suffer about the same chromosomal damage for equal doses. The different radiation sensitivities observed for different mammalian organs is then due to recovery mechanisms within the cell which can repair a great deal of the damage over a period of days or months provided the cells are not required to undergo division; a highly differentiated cell needs only a small fraction of its total genetic complement for normal function, so the probability of a hit on a sensitive site is greatly reduced, and if a cell has a large RNA pool it can function on this for a long time after vital DNA is inactivated, and while the DNA is undergoing recovery. There is considerable experimental evidence to support this view. (auth)

2064 (BNL-8486) THE KINETICS OF LEUKOPOIESIS IN THE IRRADIATED MAMMAL. V. P. Bond (Brookhaven National Lab., Upton, N. Y.). [nd]. Contract AT-30-2-GEN-16. 18p. (CONF-754-2). Dep.(mn); $1.00(cy), 1(mn) OTS.

From International Business Machines Medical Symposium, Poughkeepsie and Upton, N. Y., Oct. 1964.

The kinetics of normal myelopoiesis in the mammal is presented, as well as the radiobiological response of the individual cell types comprising the myelocytic system. The degenerative phase of the myelopoietic changes following whole-body exposure of the mammal in the sublethal range and the abortive rise that ensues before final recovery commences are described. Hypotheses to explain the abortive rise are presented, and computer techniques used to test hypotheses involving possible feedback loops are discussed. No satisfactory unifying hypothesis involving feedback to a generating compartment was found. The injured cell hypothesis, while far from established, appears at present to be the most likely explanation for the abortive rise. (auth)

2065 (BNL-8491) SUMMARY OF COMMENTS ON PLANT GROWTH STIMULATION BY IONIZING RADIATION. Arnold H. Sparrow (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract AT(30-2)-Gen-16. 4p. (CONF-551-6). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Technical Meeting on the Use of Induced Mutations in Plant Breeding Programs, Rome, May–June 1964.

Data are summarized on the effects of ionizing radiation on the height, weight, growth, or yield of some 40 plants studied during the past 17 years. It is concluded that the probability of a growth stimulation effect of radiation exists in many plant species. (C.H.)

2066 (COO-1283-12) IRRADIATION PRESERVATION OF FRESH-WATER FISH AND INLAND FRUITS AND VEGETABLES. J. A. Emerson, N. Kazanas, R. A. Greig, H. L. Seagran (Fish and Wildlife Service. Bureau of Commercial Fisheries, Ann Arbor, Mich.), P. Markakis, R. C. Nicholas, B. S. Schweigert (Michigan State Univ., East Lansing), and L. L. Kempe (Michigan. Univ., Ann Arbor). Aug. 1964. Contract AT(11-1)-1283. 100p. Dep.; $3.00 (cy), 2(mn) OTS.

Preliminary results are reported from an evaluation of the effectiveness of radiation processing for extending the refrigerated storage life of fruits and vegetables. It was concluded that irradiation pasteurization is able to significantly extend the refrigerated storage life of certain fresh-water fish as well as inland fruits and vegetables. Low-level irradiation may also prove to be of value for improving certain other characteristics of foods. In the case of yellow perch fillets, a preliminary test on fillets irradiated at either 0.0, 0.2, or 0.5 Mr and held at 36°F indicated the irradiated samples to be quite acceptable organoleptically at 3 weeks of storage, whereas the controls spoiled between the first and second week. Mold appearance on strawberries was delayed by 4 to 8 days with 200 krad of either gamma or 0.6 Mev electron irradiation. After onset, the moldiness outbreak continued with almost the same rate in irradiated and control fruits. Gamma irradiation at a dose of 5 krad prevented sprouting of Arenac potatoes for at least 6 weeks. This experiment indicates that it may be possible to avoid losses by sprouting during conditioning of potatoes for chipping, without impairment of the quality of the chips, through irradiation of the potatoes at a dose between 2.5 and 5.0 krad. (C.H.)

2067 (EUR-1893.i) RAPPORTO TECNICO SULLE ATTIVITA' DEL GRUPPO EURATOM PER LE RADIAZIONI E LA CITOGENETICA UMANA DELL'UNIVERSITA' DI PAVIA DAL 1-10-1963 AL 29-2-1964. (Progress Report of Euratom Research Group for Radiation Effects and Human Cytogenetics, Pavia University, October 1, 1963 to February 29, 1964). M. Fraccaro (Pavia, Italy. Università). 1964. 4p. Dep.(mn).

2068 (ORNL-3700(p.34-57)) CYTOLOGY AND GENETICS. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies on the mutagenic effects of triethylenemelamine in Paramecium aurelia; the effect of streptomycin or chloramphenicol on macromolecular synthesis in Paramecium; the inheritance of temperature sensitivity in Paramecium; the effects of ultraviolet radiation on the DNA content of Tetrahymena periformis; the role of RNA during regeneration in Stentor coeruleus; the photoreactivation of ultraviolet-damaged Escherichia coli; the circular genetic map of bacteriophage; radioinduced chromatid exchanges in chromosomes; the effects of 5-fluorodeoxyuridine on DNA synthesis in Vicia faba; the ef-

fect of 5-aminouracil on DNA synthesis in Vicia faba roots; the effects of far-red and red light on chromatid aberrations induced by x irradiation of Tradescantia microspores; x radiation and neutron induced chromosome breaks in barley; thymine dimers induced by ultraviolet radiation in hamster cells in culture; the effects of 5-aminouracil on mitosis and growth rate of cells of Vicia faba roots; genetic damage in mutations of Neurospora induced by x radiation; the mutagenic effects of the polycyclic hydrocarbon 3,4-benzpyrene in Neurospora; the genetic effects of high-energy protons and heavy ions in Neurospora; the effects of storage time, temperature, and atmosphere on survival of Neurospora conidia; variations in the frequency of chromatid aberrations in hamster cells in culture induced by x radiation and ultraviolet light during different stages of the cell cycle; the effects of pretreatment with purine and pyrimidine analogs and 5-bromodeoxyuridine on chromosome aberrations induced by x or ultraviolet radiation in hamster cells in culture; genetic factors affecting the proliferation of transplanted marrow cells in mice; and properties of serum albumin and esterase in mice. (C.H.)

2069 (ORNL-3700(p.58-62)) DROSOPHILA CYTOLOGY AND GENETICS. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies on the detection and localization of recessive lethals at a specific locus in Drosophila; the cytology of radioinduced mutants in Drosophila; chemically induced mutations of Drosophila; and a description of chromosome rearrangement and mutations of Drosophila melanogaster. (C.H.)

2070 (ORNL-3700(p.69-76)) CELL GROWTH AND DIFFERENTIATION. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies on cell growth and differentiation in amphibians. Data are presented on the extrachromosomal nucleolar DNA in oocytes of Triturus pyrrhogaster; DNA synthesis during lens regeneration; an immunohistochemical study of protein in regenerating lens of newts; the effects of x radiation on lens regeneration in Triturus viridescens; lens regeneration in the adult salamander, Amblystoma opacum; RNA synthesis during amphibian embryogenesis; the effects of heterogeneous histones on the differentiation of isolated amphibian ectoderm; and comparative studies on avian and amphibian lipovitellin. (C.H.)

2071 (ORNL-3700(p.77-82)) RADIATION MICROBIOLOGY. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies of the effects of growth conditions on the radiosensitivity of Escherichia coli, Salmonella typhimurium, Aerobacter A, Aerobacter B, Alcaligenes sp., Erwinia sp., and Proteus mirabilis; a genetic analyses of a radiosensitive Escherichia coli; bacterial conjugation; the genetic structure of Escherichia coli; and enzyme reactions in Escherichia coli. (C.H.)

2072 (ORNL-3700(p.83-8)) MAMMALIAN GENETICS. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies of neutron-induced mutations in mouse spermatogonia; genetic differences in the reproductive capacity of irradiated female mice; genetic factors in mice; mouse mutations induced by triethylenemelamine; and the relative biological effectiveness of neutrons and x radiation as estimated by the killing of spermatogonia in mice. (C.H.)

2073 (ORNL-3700(p.95-7)) HUMAN CYTOGENETICS. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies of radioinduced chromatid aberrations in Vicia faba root tips exposed to doses of 37.5, 75, or 150 R x radiation; nucleolar alteration in phytohemagglutinin-stimulated human leukocyte cultures; and chromosome aberration rates in human leukocytes exposed to neutrons at dose rates ranging from 1 to 4 rads/min. (C.H.)

2074 (ORNL-3700(p.98-100)) AEC-NASA SPACE BIOLOGY PROGRAM. (Oak Ridge National Lab., Tenn.).

The preparation of stocks of Habrobracon and Neurospora conidia are reported for use in biosatellite experiments on the effects of known doses of radiation, weightlessness, and absence of diurnal cycle in plants and animals. (C.H.)

2075 (ORNL-3700(p.101-11)) MAMMALIAN RECOVERY. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies of mortality from secondary disease in irradiated mice treated with injections of bone marrow; muramidase activity in spleen and kidney of irradiated mice; nitrogen balance in mouse radiation chimeras; the lipid content of mouse tissues after transplants of isologous or homologous bone marrow; electron microscopic observations on tritiated-thymidine-labeled germinal cells of mice; the effects of actinomycin D on the primary immune response in mice; the value of radioprotective agents in preventing acute lethality from chemical carcinogens in mice, with emphasis on the protective effects of AET against the acute toxicity of dimethylnitrosamine; environmental conditions that support the erythropoietic capacity of mouse bone marrow cells in culture; immune response in mice and mouse hemopoietic cells in culture; and the incidence of Pseudomonas bacteremia in irradiated mice. (C.H.)

2076 (ORNL-3700(p.113-26)) PATHOLOGY AND PHYSIOLOGY. (Oak Ridge National Lab., Tenn.).

Data are presented on lethal radiation doses for adult snakes, Elaphe absoleta (rat snake) and Coluber constrictor (black racer), and adult box turtles, Terrapene carolina. Progress is reported in studies on the effects of blood platelet transfusions on platelet production in rats; factors affecting the stem cell pool in transplanted mouse bone marrow; the incidence of spontaneous and radioinduced leukemia in germ-free mice; the propagation of a mouse leukemia virus in cells in tissue culture; the relationship between viral RNA and cell messenger RNA; the development of disk electrophoresis techniques for the study of mouse plasma esterases; the use of de Serres multicompartmented petri dishes for the rapid identification of enteric bacteria by carbohydrate fermentation reactions; and the effects of doses of 5 to 400 rads γ radiation on the incidence of leukemia and other neoplasms, longevity, and the various degenerative changes associated with aging in mice. (C.H.)

2077 (ORNL-3700(p.180-6)) BIOPHYSICS. (Oak Ridge National Lab., Tenn.).

Progress is reported in studies of electron spin resonance phenomena in native and irradiated biological materials; the dosimetry of β particles; photoreactivation of Escherichia coli; the production of thymine dimers in bacterial spores by ultraviolet radiation; and the degradation of DNA in x irradiated Escherichia coli. (C.H.)

2078 (ORNL-P-652) INTERACTION BETWEEN NONALLELIC MUTATIONS IN NEUROSPORA. Frederick J. de Serres (Oak Ridge National Lab., Tenn.). [1964]. Contract W-7405-eng-26. 28p. (CONF-734-2). Dep.(mn); $2.00 (cy), 1 (mn) OTS.

From Symposium on Genes and Chromosomes Structure and Function, Buenos Aires, Nov.-Dec. 1964.

The development of a new procedure for forward mutation experiments in Neurospora makes it possible to induce, maintain, and analyze the same spectrum of genetic alterations at specific loci in this organism as is found at specific loci in diploid organisms. Results are reported from studies on the identification of mutations in natural and x irradiated Neurospora. Emphasis is placed on the identification of mutations with spreading effects and the development of techniques for more critical genetic analysis. (C.H.)

2079 (ORNL-P-656) THE METABOLIC PROBLEM IN SECONDARY DISEASE. A. L. Kretchmar (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.) and C. C. Congdon (Oak Ridge National Lab., Tenn.). [1964]. Contract W-7405-eng-26. 13p. (CONF-717-3). Dep.(mn); $1.00(cy), 1(mn) OTS.

From CNRS Meeting on Graft of Allogenic Hematopoietic Cells, Paris, Sept. 1964.

Highly significant changes in the level of aspartic acid in liver and the activity of lysozyme (muramidase) in kidney of mice were detectable 5 and 7 days after irradiation and treatment with allogeneic bone marrow. There was other evidence of a disordered metabolism of the host, particularly in amino acid metabolic pathways, and this disorder was detectable at 5 days and subsequently appeared to spread and involve other systems than aspartic acid metabolism. It is concluded that these biochemical results indicate that a disordered host metabolism is a very early consequence of transplantation of allogeneic cells. This is presumably the result of a methotrexate-sensitive component of the grafted cells whose early activity may lead to secondary disease by injury to an as yet unidentified target system or systems in the pathways of intermediary metabolism in host tissues. Evidence of this injury is detectable before the graft had reconstituted the hemopoietic system of the chimera, before the dramatic histopathologic changes in the lymphoid system are manifest, and before the chimera is clinically distinguishable from its syngeneic marrow-treated control. (auth)

2080 (SAN-100-1) EFFECT OF IRRADIATION ON THE MICROBIAL FLORA SURVIVING IRRADIATION PASTEURIZATION OF SEAFOODS. Final Summary, May 1963–April 1964. R. O. Sinnhuber and J. S. Lee (Oregon State Univ., Corvallis). Contract AT(04-3)-502. 68p. Dep.; $3.00(cy), 2(mn) OTS.

Microbial growth characteristics in dover sole (Microstomus pacificus), irradiated at 0.1, 0.25, 0.3, and 0.5 megarad, and stored either at 34 or 43°F were examined. Significance of the findings on the wholesomeness and shelf life of refrigerated radiation processed fish are discussed. (C.H.)

2081 (USNRDL-TR-784) ACCUMULATION OF LETHAL IRRADIATION DOSES BY FRACTIONATED EXPOSURE TO X RAYS. J. S. Krebs and R. W. Brauer (Naval Radiological Defense Lab., San Francisco). Sept. 22, 1964. 23p.

The LD_{50} of mice for exposure to daily fractionated irradiation was measured for fractionation periods of from 5 to 60 days. The amount of recovery occurring during the fractionation was found to depend largely on the number of dose fractions, rather than on the size of fractions or the total time duration. The amount of recovery did not agree with the model involving exponential decay of injury with time after exposure. The results suggest that the biological basis for the recovery is the prompt repair of sublethal injury to vital cells of the mouse during the intervals between exposures to radiation. The existence of similar recovery patterns in previous studies of dose fractionation is pointed out. The relationship of the present pattern of radiation exposure to other patterns for chronic radiation exposure is discussed briefly. (auth)

2082 (ANL-Trans-121) EFFECT OF X RAYS AND γ RAYS OF Co^{60} UPON THE GROWING RABBIT LARYNX. A CONTRIBUTION TO THE RB-EFFECT OF THE Co^{60} γ-RADIATION UPON THE CARTILAGE. Th. Hornykiewytsch. Translated by Elmar K. Wilip (Argonne National Lab., Ill.), from Biophysik, 2: 222-3(1964). 3p. Dep.(mn); $1.10(fs), $0.80(mf) JCL.

The biological effectiveness of doses of 500 to 4000 R x radiation and ^{60}Co γ radiation on the growing cartilage of the larynx of infantile rabbits was studied in a series of experiments. It is pointed out that the growth of the larynx is stimulated by sex hormones. A radiation dose of 1000 R x radiation and 1400 R γ radiation eliminates this hormonal control so the cartilage shows no radiation effects above this dose, except where a morphologically detectable serious injury has occurred. Below this dose a relation between the endocrine system and radiation injury was observed. (C.H.)

2083 (JPRS-27239) EFFECT OF RADIATION ON NUCLEIC ACIDS. Translated from Dokl. Akad. Nauk SSSR, 157: 975-81(1964). 15p. (TT-64-51494). $1.00(OTS).

The relation between radioresistance and nucleic acid content was examined in E. coli B, B/r, K_{12}, and variants thereof resistant to different antibiotics and differing in degree of radioresistance. Tests were performed on 18-hr cultures in stationary phase. X-ray sensitivity was determined from dose curves that were exponential for all variants. Nucleic acid content was determined in the dry bacterial mass and calculated per cell. Results indicated that increased radioresistance is accompanied by increased DNA and RNA content. The relation between nucleic acid content and radioresistance was not significantly altered by temperature of postirradiation growth. (H.M.G.)

2084 ELEMENTS OF RADIOPATHOLOGY. Horton A. Johnson (Brookhaven National Lab., Upton, N. Y.). Acta Iberica Radiol.-Cancerol., 19: 247-54([1964]). (BNL-8258). (In Spanish)

The effect of ionizing radiation on the individual is the result of a complex chain of events, starting with the absorption of radiant energy, followed by molecular effects, cellular response, tissue exchanges, and ending with effects on the organism as a whole. In order to obtain the widest possible interpretation of the nature of radiation injury, each of these effects is considered separately. (tr-auth)

2085 EFFECT OF X-IRRADIATION ON THE INTESTINAL EPITHELIUM OF THE GOLDFISH, CARASSIUS AURATUS. I. HISTOLOGICAL CHANGES IN THE INTESTINE OF IRRADIATED FISH. Yasuko Hyodo (National Inst. of Radiological Sciences, Chiba, Japan). Annotationes Zool. Japon., 37: 104-11(June 1964).

Following whole-body irradiation with x rays, characteristic changes took place in the histological structures of the intestinal epithelium of goldfish. With 8 and 32 kr, i. e. doses of the so-called dose-independent range, the mitosis of epithelial cells was completely inhibited and the epithelial cells were reduced in number. Irradiated fish invariably died within a short period. Irradiation with 2 kr caused serious intestinal damage in some individuals but not in others. The post-irradiation survival period was much longer in the latter than in the former. Smaller doses (0.5 and 1 kr) which did not cause any marked intestinal damage were not at all lethal. On the basis of these findings, it seems probable that intestinal damage has an important bearing on acute radiation death in irradiated goldfish. (auth)

2086 HUMAN POPULATION RADIATION STUDIES. H. Auerbach (Argonne National Lab., Ill.). Argonne Natl. Lab. Rev., 1: No. 4, 13-16 (Oct. 1964).

A review on human population radiation studies is presented as derived from several reports and journal articles previously written by the author. Some of the types of surveys done with human populations are considered and the difficulties in doing significant studies on such populations are indicated. (P.C.H.)

2087 GLUCOKINASE ACTIVITIES AND GLYCOGEN CONTENTS OF LIVERS OF NORMAL AND HYPOPHYSECTOMIZED, X-IRRADIATED RATS SUBJECTED TO DIFFERENT NUTRITIONAL TREATMENTS. B. Borrebaek, S. Abraham, and I. L. Chaikoff (Univ. of California, Berkeley). Biochem. Biophys. Acta, 90: 451-63(Sept. 4, 1964).

The effect of a lethal dose (1000 R) of whole-body x irradiation on glucokinase (ATP: D-glucose 6-phosphotransferase, EC 2.7.1.2) in a number of tissues of the rat was studied. In high-glucose-fed rats, x irradiation depressed the activity of this hepatic enzyme, but not in fasted rats. X irradiation interfered with normal dietary adaptation of glucokinase. No effect of the irradiation on glucokinase activities was observed in brain, skeletal muscle, or kidney. Diet (high-glucose) and fasting caused an adaptive response in hepatic glucokinase activity of the hypophysectomized rat, but the activity level of the enzyme was lower in this animal than in the normal rat. Dietary adaptation of hepatic glucokinase is specific to glucose, but that of hepatic glucose-6-phosphate dehydrogenase (D-glucose-6-phosphate: TPN oxidoreductase, EC 1.1.1.49) is not. The

decreasing effect of x irradiation on hepatic glucokinase in the high-glucose-fed rat continued after hypophysectomy. Thus, the elevation of hepatic glucokinase activity induced by feeding a high-glucose diet is directly affected by x irradiation. A second action of x irradiation on hepatic glucokinase, differing from the decreasing effect on the enzyme observed in the high-glucose-fed rat, is a slowing rate of decline of the enzyme's activity in fasted animals and its dependence upon pituitary gland activity. A spectrophotometric method for liver fructokinase (ATP:D-fructose 1-phosphotransferase, EC 2.7.1.3) is presented. X irradiation did not affect hepatic fructokinase. (auth)

2088 MESSENGER RNA OF ULTRAVIOLET LIGHT IRRADIATED PHAGE T2. T. Minagawa, T. Okamoto, H. Aono, A. Uchida, and N. Mizuno (Kobe Univ., Himeji, Japan and Kyoto Univ.). Biochim. Biophys. Acta, 91: 158-60(Sept. 11, 1964).

Differences between RNA formed by intact phage and that formed by uv-phage were shown chromatographically. Results indicated that: the DNA for late protein synthesis is uv-sensitive, or that DNA which has a code for regulating late protein synthesis is uv-sensitive. (H.M.G.)

2089 REQUIREMENT FOR CONTINUOUS PROTEIN SYNTHESIS FOR THE DEVELOPMENT OF RESISTANCE TO ULTRAVIOLET LIGHT IN HEp-2 CELLS INFECTED WITH HERPES SIMPLEX VIRUS. Philip R. Roane, Jr. and Bernard Roizman (Johns Hopkins Univ., Baltimore). Biochim. Biophys. Acta, 91: 168-70(Sept. 11, 1964).

The study deals with the role of protein synthesis in the development and maintenance of resistance to ultraviolet light of HEp-2 cells infected with Herpes simplex virus. The data show: that the ability of virus-infected HEp-2 cells to form plaques becomes resistant to inactivation by ultraviolet light between 1 and 4 hr after infection; and that the development and maintenance of the resistant state requires new and continuous protein synthesis. Findings are interpreted in the following way: infected cells synthesize a protein capable of repairing damage caused by ultraviolet light; the protein reaches a maximum concentration between 3 and 4 hr after infection at a time corresponding to the onset of synthesis of viral DNA; and its functional life is no longer than 3 to 4 hr. (auth)

2090 THE EFFECT OF A SINGLE 2,000 R EXPOSURE OF X RAYS UPON THE UPTAKE OF ^{35}S BY THE MOUSE KNEE JOINT. C. W. Wilson (Westminster Hospital, London). Brit. J. Radiol., 37: 847-51(Nov. 1964).

The effects of local x irradiation (2000 R) on the uptake of ^{35}S sulfate by the mouse knee joint were studied to determine radiation effects on cartilage and cartilage ground substance. Left hind limbs of six-week-old male albino mice were irradiated to well above the knee joint. At a required interval after irradiation, the animals were injected intraperitoneally with ^{35}S sulfate. Determinations of ^{35}S sulfate uptake were made at a range of intervals to 23 weeks following irradiation. After an initial diffuse uptake, a small increase in uptake of the isotope was noted during the first five weeks, followed by 10 weeks of steadily increasing uptake, beyond which uptake fell progressively with time towards more normal values. (H.M.G.)

2091 THE INDUCTION OF MUTATION IN YEAST BY THERMAL NEUTRONS. H. Hrishi and A. P. James (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Genet. Cytol., 6: 357-63(Sept. 1964).

The efficiency of thermal neutrons in producing mutations from histidine dependence to independence in diploid yeast was compared with that of gamma rays. At equivalent absorbed doses, the yield of mutations was higher with neutron irradiation. In contrast, when percent survival was chosen as the basis of comparison, the yield was higher with gamma irradiation. There is evidence that the mutations under study were associated with chromosome aberrations, and the apparent relative mutagenic inefficiency of thermal neutrons is attributed to a reduced survival of mutants under conditions of thermal neutron irradiation. (auth)

2092 STUDY OF THE LOWERING OF THE THRESHOLD OF LEUKEMOGENIC EFFECT OF X RAYS ON C57Bl MICE. G. Rudali, J. Reverdy, and P. Jullien (Laboratoire de Génétique de la Fondation Curie, Paris). Compt. Rend. Soc. Biol., 158: 675-8(1964). (In French)

The effect of age on the threshold dose for leukemogenesis was studied on C57Bl mice. One series of mice received a single irradiation of 250 R on the day of their birth and a second series received the same dose at the age of six weeks. There seemed to be no reduction in the threshold of leukogenesis, but the latency period was decreased. In a second experiment to determine the effect of leukemic factors such as AkR virus, newly born mice were injected with an extract containing a leukemic virus AkR. Adult mice, 50 days old, were injected with the same extract and half of them exposed to a single x ray dose of 250 R. Another series of 50-day old mice received injections of methylcholanthrene. The joint administration of AkR or methylcholanthrene and x rays at 250 R did not augment the frequency of leukemia. (J.S.R.)

2093 PRELIMINARY STUDIES ON THE GASTRIC TRANSIT IN RATS SUBJECTED TO ULTRAVIOLET RADIATION. G. Pérès and J. Dumas (Faculte des Sciences, Lyon). Compt. Rend. Soc. Biol., 158: 773-5(1964). (In French)

The effect of ultraviolet radiation on the gastric transit of a solution of isotonic glucose was studied. The male rats used in the study were placed on a water diet for 24 hrs before the experiments. The rats placed in an enclosure lit only by ultraviolet lamps received the solution of isotonic glucose directly in the stomach. After 20 min, they were sacrificed, and the glucose content of the stomach determined. The results showed that ultraviolet radiation exercises an unfavorable effect on the speed of the gastric transit. Such an effect does not appear to result from a direct excitation of the cephalic receptors. It was observed that placing the rats in darkness had a retarding influence of less importance than the UV irradiation. (J.S.R.)

2094 STUDY OF THE COMBINED EFFECTS OF CYCLOPHOSPHAMIDE (ENDOXAN) AND LOCALIZED IRRADIATION ON BONE MARROW IN THE RAT. EFFECTS OF RELATIVE DOSE ADMINISTERED. André Chevallier, S. Manuel, and D. Chateau (Faculté de Médecine, Strasbourg). Compt. Rend. Soc. Biol., 158: 844-6 (1964). (In French)

The combined effects of endoxan and localized x radiation on the tibia of rats were investigated. X-ray doses of 50, 100, and 500 r were combined with endoxan doses of 3.6, 7.5, and 15 mg/kg body weight. The number of cells destroyed was a measure of the effects. The results showed that the summation effect does not appear at high doses of endoxan. It does appear for low and average doses combined with average and high irradiation doses. (J.S.R.)

2095 COMPARATIVE STUDY OF MODIFICATION OF THE MEDULLOGRAM IN LOCALIZED IRRADIATION AND IN GENERAL IRRADIATION IN THE RAT. C. Michaud, S. Manuel, and A. Chevallier (Faculté de Médecine, Strasbourg). Compt. Rend. Soc. Biol., 158: 846-51(1964). (In French)

Rats were exposed to localized radiation on the tibia and a whole-body irradiation at 100 and 200 R, and 24 hr after irradiation the animals were sacrificed and the medullary modifications were observed at the level of the tibia. The results are tabulated. Under light irradiation the sharpest differences in the effects of localized and whole-body irradiation was in the behavior of the polynuclei and the lumphocytes. The very marked differences in localized and whole-body irradiation for low doses are attenuated somewhat for high doses. These differences consist in a stability of the lymphocytes in localized irradiation, opposed to their decrease in whole-body irradiation. (J.S.R.)

2096 EFFECTS OF AGE AND X RAYS ON THE CALCIUM CONTENT OF THE COSTAL CARTILAGE IN

THE RAT. C. Onkelinx (Université, Liège and Populations Civiles, Liège). Compt. Rend. Soc. Biol., 158: 912-14(1964). (In French)

The rate of calcification in the costal cartilage in the normal and irradiated rat was compared as a function of age of the female rat, aged 28 to 32 days at the beginning of the study. The irradiated rats were exposed to a single whole-body dose of 350 R. The results showed the x radiation did not modify the calcification processes observed up to 9 months. (J.S.R.)

2097 COMPLEMENTARY STUDY OF OXYGEN CONSUMPTION OF THE RAT SUBJECTED TO LETHAL X IRRADIATION. M. Lemaire and J. Closon (Université, Liège). Compt. Rend. Soc. Biol., 158: 194-16(1964). (In French)

It was shown previously that the thyroid hormone does not increase significantly the respiratory exchanges of the rat irradiated with a lethal dose 5 days previously. The study was repeated by varying the time after the irradiation and by following the evolution of the oxygen consumption for several consecutive days. The results show that the increase of the oxygen consumption in response to an injection of thyroid hormone is sharply decreased from the 24th hr after exposure to whole-body dose of 800 R. Four days after x irradiation, injection of the hormone does not modify the oxygen consumption (J.S.R.)

2098 RELATIONSHIP BETWEEN SURVIVAL TIME AFTER EXPOSURE TO X-RAYS AND DOSE OF THE IRRADIATION IN THE FISHES, CARASSIUS AURATUS AND ORYZIAS LATIPES. N. Egami, H. Etoh, C. Tachi, and Y. Hyodo (National Inst. of Radiological Sciences, Chiba, Japan). Dobutsugaku Zasshi, 71: 313-21(Oct. 15, 1962). (In Japanese)

In order to obtain some information about the cause of radiation death in teleosts, the relationship between the period of survival following exposure to x rays and dose of the irradiation was examined in the goldfish, Carassius auratus, and the medaka, Oryzias latipes. Results indicate there are several distinct ranges of x ray doses over which causes leading to death vary. At least three different kinds of radiation death were distinguishable in the fishes. Furthermore, the dose-survival time relationships found in the fishes were compared with those in mammals, and the reasons for the difference found between these two classes of vertebrates are discussed. (auth)

2099 INCREASE IN TRANSPLANTABILITY OF THE FIN OF THE GOLDFISH, CARASSIUS AURATUS, AFTER X-IRRADIATION. H. Etoh (National Inst. of Radiological Sciences, Chiba, Japan). Dobutsugaku Zasshi, 72: 293-4 (1963). (In Japanese)

The effects of x irradiation on the transplantability of the anal fin of the goldfish were studied. The anal fin was transplanted into muscle near the dorsal fin 24 hours after x irradiation of 1000 R. All of the homotransplants between nonirradiated fish were rejected within 40 days. Most of the autotransplantations survived for the same period and the rate of rejections of the transplants decreased following x irradiation of the hosts. From these results it seems probable that the formation of antibodies in the host is reduced by x irradiation in goldfish as it is in mammals. (auth)

2100 THE EFFECT OF γ-IRRADIATION ON THE PHYSIOLOGICAL RESPONSES OF THE NERVE-MELANOPHORE SYSTEM IN CARASSIUS CARASSIUS. H. Etoh (National Inst. of Radiological Sciences, Chiba, Japan). Dobutsugaku Zasshi, 72: 277-82(Oct. 15, 1963). (In Japanese)

The effect of γ irradiation on the physiological responses of nerve-melanophore system in the fish, Carassius carassius, is reported. Isolated split preparations of the caudal fin of Carassius were used as test materials. A solution of adrenalin (10^{-5} M) which is known to act directly on the melanophore itself was applied as a concentrating agent, and an atropine solution (5×10^{-5} M) was a disperser In order to stimulate the nerve endings, KCl (M/7.5) was used as a concentrating agent, and NaCl (M/7.5) as a dispersing agent. Stimulation by electric current (1 V/mm of AC) was used for excitation of the concentrating nerve fibers. Responses of melanophores to these stimulations were recorded with the photoelectric recording method. At first, the responses of the melanophores to adrenaline or atropine were recorded for each preparation, and then they were irradiated with ^{60}Co γ rays at doses of 62.5, 125, 250, 375, 500, and 625 kR (dose rate was about 12.5 kR/min in air). After irradiation, the preparations were retested with the same drugs. Dose-response curves of irradiated melanophores were sigmoid weak but definite responses to both agents were recognizable, even after 625 kR of γ irradiation. In addition to adrenaline and atropine, salt solutions of KCl or NaCl were used for stimulation of the nerve endings. Measurements were conducted in the same manner as for adrenaline and atropine. The doses used were 62.5, 125, 250, and 375 kR, and the curves were convex shape in this case. Both the responses to KCl and NaCl disappeared after exposure to 375 kR of γ rays. The data suggest that radiation has a more harmful effect on the dispersing processes of the nerve-melanophore system than on the concentrating processes. A comparison of the various responses of the nerve-melanophore system to the treatments indicates the radiosensitivity of the nerve fibers is the highest, that of the melanophore is the lowest, and that of the nerve endings lies between the two. (auth)

2101 THE EFFECTS OF WHOLE BODY X-IRRADIATION ON THE HEMATOPOIETIC TISSUE IN THE GOLDFISH, CARASSIUS AURATUS. K. Aoki (National Inst. of Radiological Sciences, Chiba, Japan). Dobutsugaku Zasshi, 72: 283-8(Oct. 15, 1963). (In Japanese)

The common goldfish, Carassius auratus, was irradiated with 1, 2, 4, or 8 kR of x rays and kept in water at 23°C. Three to 21 days after irradiation, the head kidneys of the fish were weighed and fixed in Bouin's fluid for histological examination. The head kidney was reduced in weight after whole-body irradiation. Many hematopoietic cells were found in the head kidney of nonirradiated fish, but their number was considerably decreased following irradiation with lethal doses (4 and 8 kR) within 3 days. Changes in the number of the hematopoietic cells in fish irradiated with 1 or 2 kR are described. It is evident from the results that the cell number decreased within 5 days after irradiation with 1 or 2 kR of x rays but it recovered on the 21 days after irradiation if the irradiated dose was 1 kR. Irradiation of fishes with 1 kR produced no marked changes in mortality at least during the following 21 days but in the 2 kR group many fishes died by the 14th day. From these facts, it is likely that the cell number is highly correlated with radiation death. These findings seem to support the conclusion that the hematopoietic tissue is one of the critical organs in acute radiation death in teleost fish as has been shown in mammals. (auth)

2102 THE CYTOLOGY OF THE RADIATION GYNOGENESIS AND ANDROGENESIS IN MISGURNUS FOSSILIS L. D. D. Romashov and V. N. Belyaeva (Inst. of Biological Physics, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 157: 964-7(Aug. 1, 1964). (In Russian)

In irradiating sperm or egg cells in amphibians and fish, the degree of damage to the fetus (death or production of freaks) increased with increasing dose only to a certain dose limit where the damage apparently decreased with a further increase in dose. Sperm and fish eggs were given a dose of 100 to 1000 kr. The percent of embryonic deaths during incubation, the percent of monsters hatched, and the percent of anaphases and telophases with chromosomal bridges in the gastrula stage were determined as a function of irradiation dose to the sperm or egg cells. The percent chromosomal bridges in the gastrula attained a maximum at a dose of 1.5 to 8 kr, and then fell to a level only slightly above the controls at a dose of 100 kr and higher. The number of fetal deaths, and the percent freaks and monsters hatched also showed a maximum with a subsequent decrease

at high doses of 30 to 50 kr. Cytological data, which showed the state of a sperm cell in the first mitosis after irradiation doses of 0.5, 3.5, 10, 33, 66, 200, and 600 kr, indicated that the damage to the cell undergoes a basic change at higher doses. Significant pycnosis of the nucleus was observed at a dose of 33 kr and higher with most of the chromatin in the center of the spindle at the anaphase stage. At very high doses of 200 and 600 kr, the sperm nucleus was a dense pycnotic formation which was completely eliminated. (TTT)

2103 THE COMBINED EFFECT OF LOW-FREQUENCY VIBRATION AND A 50-r DOSE OF X RAYS ON THE BONE MARROW CELLS OF MAMMALS. Yu. S. Deemin (Inst. of Biological Physics, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 157: 972-4(Aug. 1, 1964). (In Russian)

The combined effect of vibration and radiation was investigated by vertically vibrating white mice at a frequency of 70 cycles/sec for 20 minutes, and then giving the mice a 50-r dose of x rays 3 to 5 minutes after the vibration period. The mice were killed at 0.5, 1, 2.5, 5, 7, 10, 15, 18, 24, 28, 32, 36, 42, and 48 hours after the irradiation, and an analysis of rearrangements at anaphase was carried out. Mice given a 50-r dose of x rays served as a means of comparison. A detailed comparative analysis did not show an increase in the number of disrupted mitoses under the combined effect of vibration and irradiation compared to the effect of irradiation alone. The number of chromosomal rearrangements decreased slightly and the number of cells with conglomeration increased slightly under the combined effect of vibration and irradiation. (TTT)

2104 EFFECT OF GAMMA IRRADIATION AND NUTRIENT INTAKE (REPORT 1). Akitsugu Kenmoku and Hiroyuki Iwao (National Inst. of Nutrition, Tokyo). Eiyogaku Zasshi, 20: 69-76(Mar. 1962). (In Japanese)

Rats were maintained on a restricted test diet of 15 g a day for 10 days. ^{60}Co gamma irradiation was given over the whole-body at a dose of 600 R. Excretion of total nitrogen was increased by the irradiation and it was markedly high in the 8% casein diet group in comparison with the 25% group. The irradiation elevated the excretion of urea-nitrogen and the excretion of allantoin-nitrogen was affected by the irradiation. In the 8% casein group, the increase was as high as the total nitrogen, whereas the 25% casein group did not show a significant increase. It is concluded that the 8% casein group received a large damage, whereas the 25% casein group received a less effect. (auth)

2105 EFFECTS OF GAMMA IRRADIATION AND NUTRIENT INTAKE (REPORT 2). Akitsugu Kenmoku and Hiroyuki Iwao (National Inst. of Nutrition, Tokyo). Eiyogaku Zasshi, 21: 37-40(Mar. 1963). (In Japanese)

Rats feeding restricted diets of 15 g per day for weeks were fasted 24 hours prior to ^{60}Co gamma irradiation of 600 R on the whole-body, and followed by 12 hours' urine collection, during which period the rats were given only tap water. Immediately after the collection period, the rats were killed by decapitation, and their livers were removed and weighed. The amount of nitrogen in the urine samples and fresh livers was measured by a semimicro Kjeldahl method. Allantoin content was also measured in urine samples. Results showed that gamma irradiation caused the enlargement of the liver. The effect was remarkable in the rats feeding on low-protein diet, but the nitrogen concentrations were almost the same in all cases. Urinary total nitrogen and allantoin excretion was increased by irradiation. The rate of the increase, however, showed little difference between high- and low-protein diets. (auth)

2106 EXAMINATION OF RADIUM-226 DIAL PAINTERS. E. Bazzano, R. Dugnani-Lonati, E. Ghislandi, and F. Rossini (CISE, Segrate, Italy). Energia Nucl. (Milan), 11: 625-9(Nov. 1964). (In Italian)

A number of workers occupationally exposed to ionizing radiation from use of Ra luminous paint were examined from the clinical, haematological, and radiotoxicological viewpoint. ^{226}Ra determination in urine was carried out. The method used, which involves coprecipitation of Ra as sulphate salt using Ba as carrier, is described. Alpha activity is measured by means of an ionization chamber and a ZnS(Ag) scintillation counter. The sensitivity of the method and of measurements is discussed, together with the reliability of results. (auth)

2107 ALLOXAN DIABETES IN ANIMALS EXPOSED TO PENETRATING RADIATION. Ya. I. Veksler, I. U. Ushaeva, L. I. Radyuk, and A. R. Sheingerts. Federation Proc., 23: Transl. Suppl., T969-71(Sept.-Oct. 1964). Translated from Probl. Endokrinol. i Gormonoter., 9: No. 3, 40(1963).

In irradiated animals, alloxan injury to the pancreas is acute at the height of radiation sickness. It is accompanied by pronounced symptoms of systemic intoxication, with sharp inhibition of the reactivity and defense mechanisms of the organism, progressive anemia, and high mortality. The chronic form of alloxan diabetes, with a relatively benign course and low mortality, is predominant in nonirradiated rats. Inhibition of the central nervous system in anesthetized rats does not prevent the development of alloxan diabetes nor mitigate the course of the disease. In healthy animals, on the other hand, the injection of alloxan during anesthesiz blocks the diabetogenic effect of the substance. Adverse environmental conditions (chilling, exhaustion, severe physical exertion) are conducive to pancreatic disease in irradiated animals even if subthreshold doses of alloxan are used. (auth)

2108 EFFECT OF GAMMA IRRADIATION ON SHASTA STRAWBERRIES UNDER MARKETING CONDITIONS. E. C. Maxie, N. F. Sommer, and Henry L. Rae (Univ. of California, Davis). Isotopes Radiation Technol., 2: No. 1, 50-4(1964).

Gamma irradiation of Shasta strawberry fruits at doses of 0.200 Mrad significantly decreased the amount of decayed berries without apparent ill effects under actual and simulated marketing conditions, provided the berries were cooled immediately after harvest and kept cool. Field infections by the principal pathogen, Botrytis cinerea Pers., are not completely inactivated, the beneficial effect of irradiation being inhibition of lesion development. Normal physiological and biochemical processes cause the loss of characteristic appearance, aroma, and flavor after approximately 21 days in cold storage. (auth)

2109 STUDY OF CHEMICAL COMPOSITION OF PLANTS FROM GRAINS OF IRRADIATED MAIZE, GROWN UNDER DIFFERENT CLIMATIC CONDITIONS. V. S. Pogosyan. Izv. Akad. Nauk Arm. SSR., Biol. Nauki, 16: No. 10, 41-50(1963). (In Armenian)

Studies of the chemical composition of plants grown from irradiated dry maize seed showed that high (2500 to 5000 R) and low (25 to 500 R) doses stimulate chemical accumulation. In spite of certain depressing effects of 5000 and 2500 R on the growth and development of the plants. The accumulation of nutrients is stimulated. The levels of nutrients in plants cultivated in the Ararat Plains are higher than in plants grown in mountainous districts. Climatic and meteorological conditions affect the rate of accumulation of nutrients in plants stimulated by 250 to 5000 R doses. (R.V.J.)

2110 STUDIES ON THE INDUCTION OF MUTATIONS IN BACTERIOPHAGE T4 BY ULTRAVIOLET IRRADIATION AND BY PROFLAVIN. John W. Drake (Univ. of Illinois, Urbana). J. Cellular Comp. Physiol., 64: Suppl. 1, 19-31 (Oct. 1964).

A general method for the interpretation at the molecular level of the genetic products of complex-acting mutagens is described, using ultraviolet mutagenesis of phage T4 as an example. The roles of different kinds of intracistronic suppressors in reversion is described. In attempts to modify the course of uv mutagenesis, both caffeine and photoreactivation were found not detectably to affect induced mutation

rates, nor was either treatment mutagenic by itself. The mutagenicity of proflavin was shown by test with FUdR to be independent of replication, and was also shown not to depend upon the special glucosylation of phage DNA. In experiments testing for a possible role of recombination, proflavin mutagenesis was not augmented by recombination-stimulating doses of uv. However, the induced mutants did appear to arise in recombinational heterozygotes. Induced mutant clones did not contain the two predicted products of unequal crossing-over. Possible mechanisms of proflavin mutagenesis were considered. (auth)

2111 MUTAGENESIS AND CHROMOSOME STRUCTURE. Frederick J. de Serres (Oak Ridge National Lab., Tenn.). J. Cellular Comp. Physiol., 64: Suppl. 1, 33-42 (Oct. 1964).

The spectra of forward-mutations occurring spontaneously (SP) or induced by x rays (X), nitrous acid (NA), or 2-aminopurine (AP) at the ad-3A and ad-3B loci of Neurospora crassa were compared by means of tests for allelic complementation and leakiness. Such tests showed a marked correlation between the percentages of leaky mutants and mutagenic origin. High percentages were found among the NA and AP samples and low percentages among the X and SP samples. The same trend was found with regard to allelic complementation among the ad-3B mutants. A set of testers derived from a 17-complon map of the ad-3B cistron also showed that complementing NA and AP mutants have predominantly nonpolarized complementation patterns with an average complon coverage of 4.7, whereas complementing X and SP mutants have predominantly polarized patterns with an average complon coverage of 13.6. These data provide striking evidence for mutagen specificity in Neurospora and suggest, furthermore, that there is a correlation between the type of genetic alteration and the type of complementation pattern. (auth)

2112 PHYSICAL CHANGES AND MUTAGENESIS. R. B. Setlow (Oak Ridge National Lab., Tenn.). J. Cellular Comp. Physiol., 64: Suppl. 1, 51-68(Oct. 1964).

Ultraviolet irradiation of DNA in vitro and in vivo results in the formation of a known structural change, the dimerization of adjacent thymines in the same polynucleotide chain. Many lines of evidence indicate that thymine dimers are responsible for a major part of the lethal, and perhaps mutagenic, effects of ultraviolet irradiation. For example: dimers are split by short-wavelength ultraviolet and by enzymic action in the presence of visible light; and the decrease in the number of dimers is well correlated with the observed increase in biological activity of DNA or increase in colony-forming ability of uv-irradiated cells. The obvious result of dimer formation is the blockage of DNA synthesis. Studies on an in vitro polymerase system indicate that, in the slow polymerization around thymine dimers, bases other than A are incorporated and that the polymerase product is not complementary to the primer. In cells of Escherichia coli, on the other hand, the major way of coping with the dimers is to remove them from the bacterial DNA in the form of small oligonucleotides. Such an error-correcting mechanism would be expected to work for all changes that affect the hydrogen bonding of normal DNA. Mistakes, in a repair mechanism, that are associated with the replacement of structurally incorrect regions in DNA by normal bases will be discussed as possible causes of mutagenesis. (auth)

2113 HISTOCHEMICAL DISTRIBUTION OF LYSOZYME ACTIVITY IN ORGANS OF NORMAL MICE AND RADIATION CHIMERAS. A. J. Speece (Oak Ridge National Lab., Tenn.). J. Histochem. Cytochem., 12: 384-91(May 1964).

A method for determining the distribution of lysozyme activity of animal tissues in situ was devised. This method was based on a microscopically visible change in the staining reaction of Micrococcus lysodeikticus after incubation with cryostat sections of fresh frozen tissue. The sections were superimposed on a specially prepared film of bacteria. The change in the bacteria, apparently proportional to the lysozyme activity of the apposed cells, was shown by staining with a mixture of Alcian blue and basic fuchsin. This also stained the animal tissue suitably for histologic examination. Lysozyme distribution in the normal mouse was determined as very active in polymorphonuclear leukocytes, Paneth cells, and hemopoietic elements of bone marrow; moderately active in lymphocytes (large more active than small), lung (apparently homogeneous), proximal renal tubule (more than glomerulus), pancreatic acinar cells, stomach glands, and lamina propria of small intestine and colon; and little or no activity in macrophages (except in lung), megakaryocytes, brain, liver, thymus, thyroid, adrenal, salivary gland, testis, upper epithelium of gastrointestinal tract, nor smooth, skeletal nor cardiac muscle. Changes in lysozyme activity in the irradiated mouse at 9 days were studied. There was an increase in lysozyme activity in the proximal tubules and glomeruli of the kidney. Acinar cells of the pancreas lost most of their activity. In the radiation chimeras the polymorphonuclear (PMN) leukocytes showed an increase in individual activity as well as increased numbers over normal. There was increased activity in the lamina propria of the gastrointestinal tract. All other changes noted could probably be attributed to the transplantation and proliferation of foreign cells and redistribution of the cellular elements of the h[illegible]imals. Acid phosphatase activity was determined f[illegible]omparison, in the same tissues, with lysozyme distribution. Acid phosphatase activity was high in macrophages, acinar cells of liver and salivary glands, villus epithelium of small intestine, proximal tubules and glomeruli of kidney. These showed apparently constant acid phosphatase activity in the normal and treated animals. Whole organ changes seemed correlated with modified cell distribution. (auth)

2114 STUDIES ON THE BIOCHEMISTRY OF EPIDERMIS. II. SOME CHARACTERISTICS OF DEOXYRIBONUCLEASES I AND II OF ALBINO GUINEA PIG EPIDERMIS AND SALINE EXTRACTS OF HAIR. Joseph Tabachnick (Albert Einstein Medical Center Research Labs., Philadelphia). J. Invest. Dermatol., 42: 471-8 (June 1964).

In contrast to rat epidermis, which contains a high level if DNase II and no DNase I activity, guinea pig epidermis has both high DNase I and DNase II activities. The ratio is about 1.14. Saline extracts of guinea pig hair or washings from the skin surface contain high DNase I activity but only traces of DNase II. About 50% of guinea pig DNases I and II and rat DNase II can be removed by washing excised epidermis. This enzymatic activity is in the interstitial compartment or originates from the Stratum corneum, or from both. The DNase II content of guinea pig epidermis is higher than that of any of the visceral organs tested; its DNase I level is exceeded only by that of the pancreas. Due to secondary changes caused by a skin surface dose of 3,000 rep beta irradiation, there is a progressive increase in epidermal extracellular DNase I, while DNase II remains unchanged or decreases by the tenth day. Evidence is presented that extracellular DNase I and DNase II activities originate primarily in the epidermis and not in the sebaceous glands or the blood. The possible role of nucleases in the disappearance of nucleic acids during keratinization is discussed. (auth)

2115 ACTIVE SITE OF DEOXYRIBONUCLEASE I. III. EFFECTS OF RADIATION ON DEOXYRIBONUCLEASE I IN DRY STATE. Shigefumi Okada (Univ. of Rochester, N. Y.). J. Radiation Res. (Japan), 4: 80-4(June, Sept., Dec., 1963).

The mechanisms of inactivation of deoxyribonuclease by direct action of radiation were studied. By testing kinetic properties of the enzyme and its tryptophan content, it seems likely that when the enzyme molecule absorbs energy from radiation, the energy is transferred to the active site of the enzyme. This results in the degradation of one tryptophan residue, which in turn, causes a loss of catalytic function of the enzyme. The differences between indirect and direct actions are also discussed. (auth)

2116 STUDIES ON THE GENETIC MULTIPLICITY OF A GENE IN YEAST CELLS. II. EFFECTS OF ULTRAVIOLET LIGHT. Terutoshi Yamasaki, Takashi Ito, and Yoriaki Matsudaira (Rikkyo Univ., Tokyo). J. Radiation Res. (Japan), 4: 85-90(June, Sept., Dec., 1963).

In the hope of obtaining the genetic multiplicity of the ad gene in yeast cells, the relation between uv dosage and forward mutation frequency was studied. It was observed that uv induced two types of mutation, fractional- and whole-colony, at the ad locus. The ratio of the whole-colony to the fractional-colony increased with uv dose. By theoretical treatment, it was deduced that the fractional-colony mutation was induced by a single-hit and the whole-colony mutation by two single-hit events in sequence, this sequence seeming to have a high probability to occur. These results support the conclusion that the genetic multiplicity of the gene is two, probably corresponding to the individual strands of double-standard DNA. (auth)

2117 EFFECTS OF RADIATIONS ON MITOSIS STUDIED BY TRADESCANTIA TEST IN VIVO. II. BETA-RAY IRRADIATION FROM A SOURCE OF STRONTIUM 90 AND CHROMOSOME BRIDGES FOUND IN CONTROL CELLS. Bungo Wada (Shizuoka Univ., Japan). J. Radiation Res. (Japan), 4: 91-6(June, Sept., Dec., 1963).

The number of dicentric chromosome bridges induced by beta-ray irradiations from a source of ^{90}Sr plate and that found in control material were counted by means of in vivo observations in Tradescantia staminal hair cells and it was confirmed that the number of bridges increased with increasing doses. In comparison of chromosome bridges found in the control material of this experiment with those recorded before the last World War, it was pointed out that effects of radioactive fallout were preserved as chromosome bridges in the staminal hair cells of Tradescantia at present. (auth)

2118 THE METHODS FOR DETERMINING THE MUTATION FREQUENCY AFTER SEED IRRADIATION IN RICE. Hikoyuki Yamaguchi (Tokyo Univ.). J. Radiation Res. (Japan), 4: 97-104(June, Sept., Dec., 1963).

In mutation breeding, mutation frequencies are expressed as the proportion of X_1 ears which segregate mutant progeny. Using the method of the segregation frequency of mutants in mutated X_1-ear-branch progenies, it could be shown that the primary branch was traced back to a single cell of rice seed embryo. Mutation frequencies were measured on the X_1 ear, X_2 plant or X_1 ear-branch basis. The deviation from the linear relationship between dose and the frequency of mutations seemed to be less on the X_1 ear-branch basis. Consequently, it was proposed to measure the mutation frequency per original treated cell as the proportion of primary branches of X_1 ear which segregated mutant progeny. Furthermore, the mutation frequencies and the segregation ratios were less in the lower primary branches of X_1 ear. It was supposed that even in haplontic selection the course of the elimination process was dependent on the environment in which the X_2 seeds were produced. (auth)

2119 ON THE INTERACTION BETWEEN THE CHROMOSOMES CARRYING THE DETRIMENTAL GENES OR GENE BLOCKS IN VIABILITY. Yoriaki Matsudaira (Rikkyo Univ., Tokyo). J. Radiation Res. (Japan), 4: 111-19(June, Sept., Dec., 1963).

An investigation was carried out on Drosophila to clarify whether or not the induced detrimental genesor gene blocks interact. It was ascertained that an interaction between genes or gene blocks for the viability in the 2nd and 3rd chromosome exists. It was also demonstrated that the spectra of viability, that is, the distribution of frequencies in viability, formed bimodal curves for irradiated 2nd chromosomes, for irradiated 3rd chromosomes, and for both irradiated 2nd and 3rd chromosomes. The spectrum of viability in the isogenic lines is discussed with inference to these results. Further, the genetic load of an organism having two interacting loci is calculated, based on the theoretical model and based on the obtained results. (auth)

2120 FOUR CASES OF THOROTRAST INJURY AND ESTIMATION OF ABSORBED TISSUE DOSE IN CRITICAL ORGANS. Akira Tsuya (Yokohama Univ., Japan), Toshihiko Tanaka, Takesaburo Mori, Tadashi Hashizume, and Yoshio Kato. J. Radiation Res. (Japan), 4: 126-45(June, Sept., Dec., 1963).

Four autopsy cases of thorotrast injury were presented, in which one case of liver cirrhosis and three cases of malignant tumors were included. The malignant tumors were diagnosed as cholangiocarcinoma, hemangioendothelioma and osteosarcoma, respectively. The dose delivered to critical organs, liver and the spleen, was measured spectrometrically and calculated using the method developed by Rundo, on the autopsy specimens. Several correction factors were introduced to obtain the final estimation of the dose. They are related to the equilibrium state of the thorotrast samples used, biological half life of ^{228}Ra, distribution of thorotrast granules in the tissue and reduction of the critical organ weight. Average tissue doses delivered were estimated as 0.58 to 2.6 rad per week for the liver and 0.92 to 5.6 rad for the spleen. Possible relationship between corrected tissue dose and pathological findings was discussed. (auth)

2121 EFFECTS OF COBALT-60 γ-IRRADIATION AND MECHANICAL DAMAGE ON SOFT WHEAT FLOUR. B. S. Miller, V. L. Koenig, H. Trimbo, and Alide Ogrins (General Mills Inc., Minneapolis). J. Sci. Food Agr., 15: 701-11(Oct. 1964).

Several cake flours were irradiated with ^{60}Co γ-rays and subjected to chemical, physicochemical and cake-making evaluation. Ball-milled and pin-milled samples were similarly studied. Damage to volume, grain and texture characteristics of white layer cakes occurred between 0.1×10^6 rads, and greater dosages caused progressively more deterioration. Profound changes in starch and protein occurred as the result of irradiation. Mechanical damage by pin- and (especially) ball-milling affected the properties of the starch and protein, but not always in the same way as irradiation. Whereas milling led to improvement in cake quality, irradiation apparently did not. (auth)

2122 EFFECTS OF THORIUM DIOXIDE ON THE PERIPHERAL BLOOD IN RATS. Hsiao-shan Yen. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 38-50(1964). (In Russian)

Extensive studies were made of the late effects of thorium dioxide on blood pictures in rats. Ten to eleven months after intratracheal administration of 300 to 400 mg/kg of thorium dioxide erythropoiesis was depressed and the number of reticulocytes was changed. The relative reduction in lymphocytes and their morphological variations were observed. Various morphological changes in neutrophils indicated a certain disturbance of granulocytopoiesis and an increase in blood platelets. Considerable changes in the numbers of reticulocytes, thrombocytes, and lymphocytes were also observed at the early stages following administration of thorium dioxide. (R.V.J.)

2123 THE RELATION BETWEEN THE ELECTRIC ACTIVITY OF THE CEREBRAL CORTEX AND PROTEIN METABOLISM IN THE CHRONIC ACTION OF IONIZING RADIATION. L. I. Ilyina, N. I. Gorbarenko, and E. A. Denisova. Med. Radiol., 9: No. 9, 8-13(Sept. 1964). (In Russian)

Electric activity of the cerebral cortex and protein metabolism in persons subjected to the chronic action of radiation during work were investigated. A total of 101 persons were examined. In the majority of cases a certain parallelism was seen between shifts in the electric activity of the brain and the content of total protein and its fractions in the blood serum, and shifts in the protein-forming function of the liver. (auth)

2124 THE INFLUENCE OF FRACTIONAL EPILATION DOSES OF X RAYS ON SOME REACTIONS OF THE ORGANISM IN CHILDREN. B. G. Belkin (Turkmen Scientific Research Inst. of Dermatology, USSR). Med. Radiol., 9: No. 9, 17-21(Sept. 1964). (In Russian)

Clinical observations were conducted in over 757 patients with dermatomycosis who underwent x-ray therapy. Recovery was noted in 753 (99.5%) of cases. Prolonged follow-up studies did not disclose epilation, x-ray dermatitis and other pathological changes of the skin. X-ray irradiation of the head by fractional epilation doses, according to data of haptic conditioned reflexes, causes a prevalence of shifts towards excitation and, according to data of serial dynamometry, a predominance of inhibition processes. One to two months later there is seen a tendency of the indices to revert to initial values. If the irradiation is more intense more marked and stable changes are observed. Studies of the indices of pharmacodynamic vasodilating reactions to adrenaline and morphium, the coefficient of trypane blue distribution and the time of physiological saline resolution during dynamic observations over patients after x-ray irradiation, at the time of epilation, growth of new hair and 6, 9 and 12 months later points to the dependence of skin reaction changes on the individual peculiarities of the organism and its initial state. (auth)

2125 THE INFLUENCE OF BCG VACCINE ON ANTITETANUS IMMUNITY IN IRRADIATED AND NON-IRRADIATED MICE. V. M. Zemskov. Med. Radiol., 9: No. 9, 67-72(Sept. 1964). (In Russian)

Results are reported of investigations relative to the influence of separate and simultaneous vaccination with the BCG vaccine and tetanus toxoid on the formation of antitetanus immunity in irradiated and nonirradiated albino mice. (auth)

2126 THE INFLUENCE OF REPEATED IRRADIATION ON ANTIBODY FORMATION IN RABBITS. E. K. Dzhikidze and A. S. Aksenova (Inst. of Experimental Pathology and Therapy, Academy of Sciences, Sukhumi, USSR). Med. Radiol., 9: No. 9, 72-5(Sept. 1964). (In Russian)

In the first series of experiments on 77 rabbits, of which 43 were subject to daily irradiation in a dose of 4 to 5.2 R for 3 to 18 months (the total dose comprising 356 to 2,039 R) no functional disturbances of antibody formation in response to three introductions of paratyphus vaccine in increasing doses (0.25, 0.5, 1 milliard) were evident. A partial inhibition of immunogenesis was noted during daily irradiation with a dose of 21 R (the total dose amounting to 2,000 R) in the second series of experiments. (auth)

2127 THE DISTRIBUTION OF RADIOPHOSPHORUS-LABELED STAPHYLOCOCCUS AUREUS IN SEPSIS COMBINED WITH BLOOD LOSS. S. M. Polischuk (Lugansk Medical Inst., USSR). Med. Radiol., 9: No. 9, 81-4 (Sept. 1964). (In Russian)

In experiments on 55 rabbits the distribution of radiophosphorus-labeled Staphylococcus aureus was studied in the organs and tissues during the combined action on the animal organism of infection, total irradiation, and moderate blood loss. In all experimental animals the greatest ^{32}P accumulation was seen in the tissues of the lungs, liver and spleen whereas it was noted in bone of control animals. A greater ^{32}P content in organs and tissues was noted in rabbits subject to Staphylococcus aureus infection with a simultaneous total irradiation. A lesser content was found in microbial infection on the fifth day after total irradiation, and the lowest accumulation was in animals subject to infection, total irradiation and a moderate blood loss. (auth)

2128 EVIDENCE FOR REPAIR OF ULTRA-VIOLET DAMAGED DEOXYRIBONUCLEIC ACID IN CULTURED MAMMALIAN CELLS. Ronald E. Rasmussen and Robert B. Painter (Ames Research Center, Moffett Field, Calif.). Nature, 203: 1360-2(Sept. 26, 1964).

The effects of ultraviolet radiation on nucleic acid metabolism in HeLa S3 cells and the Chinese hamster line DFAF-33 were studied. Results strongly suggested the existence of an active uv repair mechanism in mammalian cells. Repair was especially evident in cells that had incorporated bromouracil deoxyriboside (BUdR) into their DNA. (H.M.G.)

2129 IN VIVO MIGRATION OF COLONY-FORMING UNITS FROM SHIELDED BONE MARROW IN THE IRRADIATED MOUSE. Gerald E. Hanks (Naval Radiological Defense Lab., San Francisco). Nature, 203: 1393-5 (Sept. 26, 1964).

Utilizing the ability of stem cells to form nodules in the irradiated spleen as initially shown by McCulloch and Till, combined with short-term shielding of a portion of the bone marrow, a quantitative estimate was obtained of the rate of stem all release to the circulating blood in the thigh-shielded irradiated mouse. Changes in the release process following sub-lethal whole-body irradiation were evident. (H.M.G.)

2130 ARTEFACTUAL CHROMATID ABERRATIONS IN UNTREATED AND X-RAY-TREATED HUMAN LYMPHOCYTES. B. R. Migeon and T. Merz (Johns Hopkins Univ., [Baltimore]). Nature, 203: 1395-6(Sept. 26, 1964).

Chromatid aberrations were observed in the chromosomes of cultured infant lymphocytes following diagnostic x-ray procedures. It was found that: the frequencies of chromosomal aberrations in the x-rayed infants was higher than that expected for the particular dose given; considerable numbers of aberrations appeared in the control groups; and the predominant aberration type was the chromatid deletion. (H.M.G.)

2131 GENETICAL RESEARCH IN AN AREA OF HIGH NATURAL RADIOACTIVITY IN SOUTH INDIA. H. Grueneberg (London Univ.). Nature, 204: 222-4(Oct. 17, 1964).

The mutagenic effects of chronic exposure to low-levels of radiation were studied in black rats inhabiting Quilon, an island off the Malabar Coast of India. Monazite sand causes the average radioactivity of the strip to be 7.5 times that of the inland area serving as the control. Thus individual rats on the strip during their total reproductive lifetime accumulate about 1 R of γ radiation. No significant increase was found in the frequency of variance appearing in the island rats. It is assumed that genetic variance although increased by the radiation is counterbalanced by a decrease in non-genetic variance. Whereas no positive indication of genetic damage to the rats was found, it is emphasized that damage not detectable by the methods used must not be ruled out. (H.M.G.)

2132 THE DYNAMICS OF PHYSIOLOGICAL PROCESSES IN RELATION TO RADIOSENSITIVITY. M. Pospisil, Y. Ueno, and J. Sikulova (Inst. of Biophysics, Brno and Kyoto Univ.). Naturwissenschaften, 51: 485(1964).

The dynamic characteristic of the urine excretion of Na and K, expressed in the Na/K ratio, was studied in order to elucidate its importance for the prediction of post irradiation mortality. Mice exposed at weekly intervals to a total of six 200-r doses of radiation. Fluctuations in the Na/K ratio were registered in the urine samples. Great time and inter-individual fluctuations were observed. The most radiosensitive animals were found in the extreme positions of the variation range. The same was true for rats exposed to one whole-body exposure of rats exposed to one whole-body exposure of 700 r. It was concluded that individuals with a low and high degree of fluctuations can be denoted as unbalanced types with adverse postirradiation prognosis. (M.C.G.)

2133 ERYTHROPOIETIC POLYPLOIDY. IV. ERYTHROPOIETIC POLYPLOIDY DUE TO I^{131} TREATMENT OF THYROID DISORDERS. Nemec Jan and Polák Hugo (Research Inst. of Endocrinology, Prague). Nucl.-Med., 4: 146-55(Jan. 10, 1964).

The degree of erythropoietic polyploidy (expressed by the index: IEP) of the bone marrow in 8 patients with thyroid cancer and 5 cases with thyrotoxicosis, both treated with radioiodine, was studied. It was found that the incidence of polyploid erythroblasts after administration of diagnostic doses of ^{131}I, compared with a group of healthy persons is slightly but significantly enhanced; after the administration of therapeutic doses in patients suffering from thyrotoxicosis or thyroid cancer, a further rise of

erythropoietic polyploidy occurred in the early phase of therapy (up to 2 months), as compared with the values found after diagnostic doses only; in a later phase after radioiodine administration (3 months to 6 years), an increase of the number of polyploid erythroblasts was established only in those bone marrows which showed erythroid hyperplasia. In marrows with a hypoplastic erythroid series the IEP value was normal. Since the determination of the IEP is neither difficult nor time-consuming, the possibility of the use of this index for the assessment of changes caused by minute radiation doses is considered. (auth)

2134 INACTIVATION OF S-RNA BY ULTRAVIOLET RADIATIONS. P. A. Swenson and S. Nishimura (Oak Ridge National Lab., Tenn.). Photochem. Photobiol., 3: 85-90(1964).

Various S-RNA's from E. coli show wide differences in sensitivity to ultraviolet radiation as measured by their amino acid acceptor capacities. S-RNA for valine is least sensitive and phenylalanine and lysine are most sensitive. S-RNA's for valine, isoleucine, glycine, aspartic acid, serine, and arginine give exponential-type dose-effect curves. Those for alanine, glutamic acid, lysine, and phenylalanine are rapidly inactivated at low doses and only at higher doses give exponential type inactivation curves having lower slopes than seen at low doses. Phenylalanine and glutamic acid S-RNA inactivated by 2650 or 2804 Å radiations are not reactivated by 2380 Å radiation, indicating that uracil dimers are not involved in the inactivation process. Heating of irradiated S-RNA to bring about rehydration of uracil residues is not effective in restoring acceptor activity of phenylalanine and leucine S-RNA. Melting curve experiments suggest that photochemical products other than uracil dimers and hydrated uracil residues are formed and result in changes in the secondary structure of S-RNA. (auth)

2135 EFFECTS OF THE GERMFREE STATE ON RESPONSES OF MICE TO WHOLE-BODY IRRADIATION. Mary M. McLaughlin, Michael P. Dacquisto, David P. Jacobus, and Richard E. Horowitz (Walter Reed Army Medical Center, Washington, D. C.). Radiation Res., 23: 333-49 (Nov. 1964).

The response of germfree, E. coli-monocontaminated, and conventional mice exposed to single whole-body doses of x ray ranging from 550 to 40,000 R was compared. Radiation effect after doses from 550 to 950 R was measured by per cent survival and survival time. These studies reveal that the germfree mouse can tolerate more radiation than either a conventional or an E. coli-monocontaminated mouse. Increased radioresistance was demonstrated by a higher median lethal dose and an increase in survival time. After exposure to supralethal amounts of x ray, survival time was used to measure radiation effect. After all doses, mice in the germfree state survived longer than mice with a single (E. coli) bacterial contaminant; monocontaminated mice survived longer than conventional or conventionalized mice. Although all mice succumbed within 10 hours after exposure to 40,000 R, a qualitative difference was still evident between the postirradiation symptoms of germfree mice and mice in the other groups. Curves depicting dose–survival time relationships are very similar for conventional and monocontaminated mice. The curve for germfree mice, although of the same general nature, differs in several ways: the threshold for acute response is higher; the survival time plateau of maximum (gastrointestinal) response is higher; the plateau of stable survival time extends over a smaller range of doses; the transition area from plateau to threshold of central nervous system hyperexcitability is extended over a greater range of doses; and the threshold of central nervous system hyperexcitability is markedly higher. The extent to which the observations can be related to cell renewal rates in the intestinal mucosa and to the presence of bacterial contamination is discussed. (auth)

2136 PRODUCTION OF "FATTY LIVER" BY X-IRRADIATION. Cesare Agostini, Angela Sessa, Alessandro Fenaroli, and Pietro Angelo Ciccarone (Universita, Milan). Radiation Res., 23: 350-6(Nov. 1964).

In regard to the pathogenesis of fatty liver after irradiation, the triglyceride-secreting mechanism from the liver to the plasma, the glucose-6-phosphatase activity of hepatic microsomes, the coenzyme A content of the liver, and free fatty acid release from epididymal adipose tissue were studied. Results have shown that, after prolonged treatment with small doses of x rays: triglyceride secretion from the liver to the plasma is greatly increased; no modification is induced in glucose-6-phosphatase activity of hepatic microsomes; coenzyme A content of the liver is decreased; and free fatty acid release from peripheral adipose tissue is notably greater. It is therefore postulated that coenzyme A deficiency and the increase in free fatty acid release from peripheral adipose tissue have probably an important role in the pathogenesis of fatty liver produced by x rays. (auth)

2137 EOSINOPHILIA AFTER EXPOSURE TO IONIZING RADIATION. S. S. Kurohara, L. H. Hempelmann, C. L. S. Englander, L. M. Fuller, and P. Rubin (Univ. of Rochester, N. Y.). Radiation Res., 23: 357-68(Nov. 1964).

The eosinophil counts of 62 patients undergoing radiation therapy for malignant disease were studied. Both male and female patients given x-ray treatments to the pelvic region showed a consistent eosinophilia which was directly related to the cumulative integral dose. In contrast, treatment of the thorax or upper abdomen of patients caused a gradual eosinopenia, and irradiation of the head and neck did not affect the eosinophil count. The eosinophilia in patients given treatments to the pelvis cannot be explained by the large integral dose used in treatment. The response did not appear to be related to sex, age, or type and stage of malignancy. The eosinophilia appeared to be species-dependent, as rats receiving comparable dose of fractionated x-ray exposure to the pelvic region showed the opposite response. Possible explanations of the eosinophilia occurring after irradiation of pelvic tissues were considered. The most plausible is that a hypersensitivity state developed as a result of the presence of antigenic proteins. Such antigens could be either heterologous proteins absorbed through the damaged intestinal epithelium or modified homologous proteins formed in damaged and dying cells. In the hypothetical hypersensitivity state so induced, the factors promoting an eosinophilic response presumably overcame the usual eosinopenic action of radiation exposure. (auth)

2138 EFFECTS OF RADIATION ON THE POPULATION KINETICS OF THE SNAIL AUSTRALORBIS GLABRATUS: AGE AT EXPOSURE AND IMMEDIATE AND LATE EFFECTS OF X-RAYS. Alina Perlowagora-Szumlewicz (National Inst. of Allergy and Infectious Diseases, Bethesda, Md.). Radiation Res., 23: 377-91(Nov. 1964).

Radiation damage in Australorbis glabratus is directly related to the developmental stage, as reflected by age at the time of irradiation. Variations in sensitivity to radiation damage could be adequately explained on this basis. Radiation damage to growth measured either by the degree of growth retardation or by the time course of recovery (catching up in growth) was found to decrease with increasing age, and to increase with the increase of the radiation dose. However, when the overall fitness of the animals to withstand radiation damage of 3000 R to 6000 R to growth was considered, by comparing the fraction of residual injury with the total amount repaired during a determined period after exposure, it was concluded that radiosensitivity was relatively stable throughout the first 3 months of the snail's life. However, with increase of radiation doses above 6000 R, radiosensitivity varied according to age at exposure and reached a peak in newborn animals. Special conditions related to the nutritional state and to the pigmentation of the soft parts of the snail at the time of irradiation seemed to be responsible for the maximum radiosensitivity of the newborn animals to growth damage. Body size was found to be a sensitive index of radiation damage in snails in which the existing correlation between

age and size, from the time of hatching until several months after maturity onset, was impaired owing to certain natural conditions detrimental to growth. Size variations occurring in the immediate progeny from nonirradiated parent snails were almost identical with those found in offspring from parents receiving different amounts of x-irradiation. This indicates that no new types of abnormalities of growth were produced by the irradiated germ cell in the first generation of offspring. (auth)

2139 EFFECT OF IONIZING RADIATION ON THE POPULATION KINETICS OF THE SNAIL AUSTRALORBIS GLABRATUS: AGE AT EXPOSURE AND THE EFFECTS ON REPRODUCTION. Alina Perlowagora-Szumlewicz (National Inst. of Allergy and Infectious Diseases, Bethesda, Md.). Radiation Res., 23: 392-404(Nov. 1964).

The over-all process of degenerative changes in the reproductive system of the hemaphroditic snail was investigated by determining egg depositions, fecundity, and fertility after irradiation. The reproductive capability, which was reduced by radiation in all animals, followed approximately the same pattern of age and dose dependency as growth, except for a second peak of radiosensitivity in old animals. Newborn animals showed much greater damage than juveniles, and changes produced in young juveniles were greater than in older juveniles. However, there is a second peak of radiosensitivity in animals 210 days old. From the analysis of the individual component traits of reproductive performance it was seen that the three functions studied displayed a certain degree of independence in response to radiation. Although damage to the ovaries, as shown by delayed and reduced egg depositions, was reparable within 3 to 5 months in animals irradiated prior to maturation, fecundity required a longer period to return to normal levels. Furthermore, fertility as expressed by viability of progeny yielded information somewhat different from that of fecundity. Although fecundity was only impaired in newborn and old animals, fertility was completely abolished after exposure to certain amounts of radiation. The hazard of inducing irreparable damage to fertility was reduced when radiation was given to animals approaching the onset of sexual maturity. Nevertheless, fertility was greatly reduced when radiation was given to animals approaching the onset of sexual maturity. Nevertheless, fertility was greatly reduced in these animals, thus suggesting some deleterious radiation effects in the germ cell. Heritability of these effects, as shown by reduced fecundity in the immediate offspring of irradiated parents, confirmed the concept of radiation injury to the germ cell being genetic in nature. The offspring of irradiated snails were less affected than their parents. This indicates that the immediate progeny were capable of eliminating, to a certain degree, conditions detrimental to the parents. It was suggested that, had progeny been derived from parents at the phase of recovery from radiation damage, their reproductive performance might have been improved. Although there was no correlation between body size and radiation damage to the reproductive performance, it was evident that naturally occurring growth retardation contributed to the increase of sensitivity of the gonadal tissue to radiation. (auth)

2140 FACTORS INFLUENCING THE DELAYED EFFECT OF IRRADIATION ON GASTRIC BIOELECTRIC ACTIVITY IN RAT. Burton E. Vaughan and A. Kennon Davis (Naval Radiological Defense Lab., San Francisco). Radiation Res., 23: 405-11(Nov. 1964).

The delayed reduction in gastric bioelectric activity reported in an earlier study shows dose dependence for midline x-ray doses between approximately 100 rads and 800 rads. The seventh-day effect also occurs after fast neutron irradiation, showing similar dose dependence between 50-rad and 400-rad midline doses. For the delayed effect to occur, three factors are absolutely requisite: irradiation, intact vagal innervation, and food in stomach (as distinguished from distention). Seven days after vagotomy, potentials are significantly above normal, a feature which masks the delayed irradiation effect. Significantly supernormal potentials also can be demonstrated 15 minutes after 540 rads and again 15 minutes after doses of approximately 10 and 30 krads. (auth)

2141 IRRADIATION EFFECT ON BIOELECTRIC ACTIVITY IN ISOLATED RAT STOMACH. Burton E. Vaughan and Joseph T. Cummins (Naval Radiological Defense Lab., San Francisco). Radiation Res., 23: 412-19 (Nov. 1964).

Bioelectric parameters have been characterized in rat stomach aerobically maintained at 34°C in vitro, and at the time of maximum electrical activity. Seven days after 560-rad and 940-rad doses to the whole body, gastric bioelectric activity is markedly reduced. Transmural potential and total short-circuit current are reduced without an increase in conductance. Irradiation inhibition of an ion transport mechanism in the stomach is indicated; this effect is probably indirect. (auth)

2142 LOCAL PLASMA VOLUME AND VASCULAR PERMEABILITY OF RABBIT SKIN AFTER IRRADIATION. D. Mount and W. R. Bruce (Univ. of Toronto and Ontario Cancer Inst., Toronto). Radiation Res., 23: 430-45(Nov. 1964).

A technique for measuring the volume of plasma and the permeability of blood vessels to serum albumin in a specimen of rabbit skin in vivo was developed and was used to examine the vascular changes after an acute local dose of x rays. Plasma volumes and permeability were determined from recordings of the radioactivity of a defined volume of skin after the intravenous injection of ^{125}I-labeled rabbit serum albumin. Normal mean values were: plasma volume 0.07 ml/gm of tissue, permeability 0.8 gm of albumin transferred per hour per gram of albumin within the vessels. After a single dose of 8000 rads of x rays, two changes were observed in these values. The volume increased by two times within a day of the irradiation. Permeability increased to ten times the normal value beginning 5 to 10 days postirradiation. The antihistamine phenergan hydrochloride suppressed the early change in volume but not the latter change in permeability. (auth)

2143 LONG-TERM EFFECTS OF NEUTRON EXPOSURE ON BONE GROWTH IN THE RAT. Richard D. Phillips and Donald J. Kimeldorf (Naval Radiological Defense Lab., San Francisco). Radiation Res., 23: 491-9 (Nov. 1964).

The long-term effects of neutrons on femur, tibia, and tail growth were studied in total-body-exposed male rats, by using a radiographic measurement technique. There were growth deficits in all three structures of the exposed animals at the end of life span. The magnitude of the reduction in bone length at the end of life span was dependent on the radiation dose and the age of the animal at the time of exposure. For animals exposed at the same age, the magnitude of the bone growth deficit varied directly with dose. For animals exposed to the same dose, the effect was greater in juvenile animals than it was in adult animals. The greater effectiveness of neutron exposure on bone growth in animals exposed as juveniles was explained on the basis of the more rapid growth rate of these animals at the time of exposure. (auth)

2144 MORTALITY, LIFE SPAN, AND GROWTH OF RATS WITH A MAINTAINED BODY BURDEN OF POLONIUM. J. N. Stannard, H. A. Blair, and R. C. Baxter (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 228-45(1964).

Life-span shortening, lethality, and growth were measured in a large experiment in which rats were maintained on a monthly injection schedule of polonium-210, given from early maturity throughout life. The body burdens of polonium, after establishment of equilibrium, averaged 0.05 (level A), 0.23 (level B), 0.60 (level C), and 2.4 (level D) μC/kg. The injections were given intravenously to a total of 483 rats, including the controls, which received saline. No retardation of growth was detected at the two lowest levels. Definite retardation of growth was seen at the highest dosage level. Life span was shortened only minimally at a maintained body burden of 0.05 μC/kg but was clearly shorter at the higher levels. A linear relationship appears between calculated dosage (microcuries disintegrating

within the body) and life-span shortening. The regression line indicated that life span in the rat is shortened approximately 17.5 weeks per microcurie of polonium disintegrating within the body. On the basis of effective dose (total polonium administered less than that remaining in the body at the time of death) the shortening is about 4.3 weeks per microcurie. Thus protraction of the dose over many months does not decrease significantly the effectiveness of α irradiation in producing life shortening, in contrast to γ or x irradiation. This is consistent with the suggestion that the injury produced by α particles is to a large extent of the irreversible type. (P.C.H.)

2145 PATHOLOGY OF SINGLE INTRAVENOUS DOSES OF POLONIUM. George W. Casarett (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 246-321(1964).

The sequences of histopathologic changes occurring in the organs of Wistar rats sacrificed periodically or dying spontaneously after single intravenous injections of Po (as the chloride) at dosage levels of 0, 1, 5, 10, and 20 μC/kg of body weight are reported. Periodic sacrifices of rats for histopathologic study were made over total spans of 584, 577, 517, 425, and 160 days post-injection for these dosage levels, respectively. The general nonneoplastic tissue changes observed included atrophy of seminiferous epithelium and hyperplasia of interstitial (Leydig) cells in testes; hypoplasia and atrophy of lymph nodes, thymus, and spleen; hypoplasia of bone marrow, especially in metaphysial and epiphysial regions; involution of growing cartilage in zones of endochondral bone growth (as observed in femur); arteriolar nephrosclerosis; vacuolization of adrenal cortical cells; atrophy of pancreas; hypoplastic and hyperplastic changes in pulmonary lymphoid tissue; obstructive pulmonary emphysema associated with partial obstruction of bronchioles by hyperplastic lymphoid tissue; and general arteriolosclerosis. The tissues most frequently involved in neoplasms were the renal tissues, the reticular and other connective tissues, endothelium, adrenal medulla, and, to a lesser extent, the gastric mucosa, hepatic tissue, testicular interstitial tissue, and skin. (P.C.H.)

2146 HEMATOLOGY OF SINGLE INTRAVENOUS DOSES OF POLONIUM. George W. Casarett (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 322-46(1964).

Histologic studies were made on rats after receiving single intravenous doses of ^{210}Po. Hematologic determinations included erythrocyte count, reticulocyte percentage, hemoglobin concentration, leukocyte count, differential leukocyte percentages, and platelet count. Included among the changes induced in the circulating blood at various times after the intravenous injection of Po were reductions of lymphocyte count, neutrophile count, erythrocyte count, and hemoglobin content of blood, and increases in neutrophile and eosinophile counts. Anemias of both normochromic and hypochromic character were encountered, as well as an apparent maturation defect in erythropoietic tissue and to a lesser extent in myelocytic tissue in some animals, associated with hyperplastic, immature marrow, and ectopic hemopoiesis. In general, changes involving depression of circulating blood cells were greater, at comparable time intervals, the higher the dose. Individual effects of 5, 10, and 20 μC/kg doses are discussed. (P.C.H.)

2147 PATHOLOGY OF MULTIPLE INTRAVENOUS DOSES OF POLONIUM. George W. Casarett (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 347-60(1964).

The pathologic effects of polonium-210 were studied in groups of male and female rats dying spontaneously after receiving monthly intravenous injections of polonium, as the chloride solution, at dosage levels of 0.0, 0.023, 0.10, 0.30, and 1.50 μC of polonium per kilogram of body weight per month. The groups or dosage levels are designated as 0, A, B, C, and D, respectively. The incidences of severe lung hemorrhage and edema and of splenic hemorrhage and pancreatic edema were increased at the C and D levels. Age-dependent obstructive pulmonary emphysema, caused by bronchial obstruction by hyperplastic lymphoid tissue and predisposing to pulmonary infection, was prematurely increased in incidence at the B level and was not seen in the shorter-lived C and D groups in which there was marked atrophy of pulmonary lymphatic tissue. Polonium treatment caused increased incidence of rats with malignant neoplasms in males at the A, B, and C dosage levels (especially at the B level). There was reduction in incidence of female rats with malignant neoplasms, owing at least partly to the increasing reduction in incidence of mammary carcinoma and other cancers with increasing dose and life-shortening and with increasing ovarian atrophy. Several specific types of malignant neoplasms were reduced in incidence at high dosage levels by virtue of shortened life span and limitation of potential induction time. Polonium injection caused arteriolar nephrosclerosis at the D level and reduced the incidence of nephritis at this dosage level. Dose-dependent radioinduced hypoplasia of gametogenic epithelium and lymphoid tissues was observed. Age-dependent involutional changes in lymphoid and myeloid hematopoietic tissues, gonads, cartilage disc in zones of endochondral bone growth, and in the arteriolocapillary system were more premature in polonium-injected rats, the larger the dosage. Comparisons of effects of multiple doses with single doses were made. (P.C.H.)

2148 PATHOLOGY OF ORALLY ADMINISTERED POLONIUM. George W. Casarett (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 361-72(1964).

The pathologic changes caused by an absorbed dose of 25 μC/kg in orally treated rats were compared with those caused by an intravenous dose of 26 μC/kg. Quantitative and qualitative differences are described and discussed with respect to their significance in toxicity and their relation to metabolism of polonium, where possible. There was less hypoplastic change in hemopoietic organs and testes, which is compatible with lesser concentration of polonium in these organs after oral as compared with intravenous administration. Hemorrhagic phenomena were much more prominent in intravenously injected rats. The principal qualitative differences in pathology, which have significance in terms of toxicity, were the development of nephrosclerosis and the occurrence of intestinal damage in animals treated orally. Rats absorbing 25 μC/kg after administration of polonium by gavage developed nephrosclerosis at a rate and to a degree, with respect to time, equivalent to that observed in rats receiving 10 μC/kg intravenously. The polonium concentrations in the kidneys of the rats receiving these different systemic doses by the two different routes were calculated to be similar. Renal damage was probably of significance with respect to toxicity in the orally treated animals after 2 or 3 months. The intestinal epithelium, especially that in the half of the mucosa nearest the lumen, was damaged considerably, which was probably of signficance with respect to toxicity in earlier periods, perhaps only during the first month. It seems clear that at the dosage levels under consideration several qualitative and quantitative differences in pathology occurred in a manner that resulted in similar lethality for the rats receiving polonium orally and those receiving a body burden intravenously that was equivalent to that absorbed in the case of gavage-treated rats. (P.C.H.)

2149 SOME LATE PHYSIOLOGICAL CHANGES IN RATS AFTER POLONIUM-210 ALPHA-PARTICLE IRRADIATION. J. A. Sproul, R. C. Baxter, and L. W. Tuttle (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 373-88(1964).

Some physiological manifestations of the long-term effects of polonium-210 in rats are described. The dosage used (10 μC/kg) was found in an earlier, separate experiment to produce many late histopathological changes, including progressive nephrosclerosis, and significant shortening of life span, but few manifestations of acute radiation sickness. Blood pressure increased significantly in polonium-treated animals at 4 months after a single intravenous injection and increased progressively over the controls at 7 and 11 months. Urine output and water consumption were increased in proportion. Control animals showed no or much less change in the period of observation. Cataract formation was markedly accelerated by the polonium treatment. Increased opacity was detected approximately 6

months after injection, whereas control rats showed no evidence of cataracts before 13 months. By 13 months all surviving polonium-treated animals had cataracts of average opacity ++, whereas only 5% of controls had an average lens opacity of + on the scale used. Graying of hair was detected after 3 months of treated animals and increased progressively in observations at 6, 9, and 12 months. The physiological changes confirmed and extended understanding of the late manifestations of α-particle irradiation. The calculated radiation doses indicate a lower relative effectiveness factor for cataractogenesis than was observed for life-span shortening. (P.C.H.)

2150 EFFECT OF POLONIUM ALPHA-PARTICLE IRRADIATION ON RETICULOENDOTHELIAL FUNCTION IN THE RAT. L. W. Tuttle and R. C. Baxter (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 389-97(1964).

The rate of removal of injected particulate ^{32}P-labeled chromic phosphate from the circulation of animals treated with polonium-210 in the $LD_{50(30)}$ range was measured at intervals from 2 to 23 days after injection. The rate is decreased moderately below control values, but this difference is not believed to be of particular biological significance, since it occurred only after very high dosages of radiation and became marked only at times when the animals were showing signs of illness. Highly irradiated spleens (5760 Rads in 23 days) and livers (540 Rads) accumulate as much of the injected material as control organs. A decrease in weight of irradiated spleens and livers seen in the polonium-treated animals was not accompanied by a reduction of phagocytic capacity. The reticuloendothelial system of the rat appeared to be highly resistant to the effects of alpha particle irradiation. Histologic studies were not done in these experiments, and therefore the possibility of injury followed by regeneration of reticuloendothelial cells cannot be ruled out with certainty. Such a change should be considered, at least in the case of spleens, which received mean cumulative doses as high as 5760 Rads by 23 days. It seems highly unlikely that destruction of reticuloendothelial cells would have been caused in the livers, which received a mean cumulative dose of only 542 Rads in 23 days. (auth)

2151 CONCLUDING COMMENTS ON BIOLOGICAL EFFECTS OF ALPHA-PARTICLE EMITTERS IN SOFT TISSUE AS EXEMPLIFIED BY EXPERIMENTS WITH POLONIUM 210. J. N. Stannard and George W. Casarett (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 398-434(1964).

A summary of the biological effects of alpha-particle emitters in soft tissue as exemplified by experiments with ^{210}Po is presented. Solution chemistry and radiocolloids, distribution and excretion, life-span shortening, pathology and hematology, functional studies, and consideration of maximum allowable concentrations and maximum permissible body burden are discussed. 92 references. (P.C.H.)

2152 RADIATION-INDUCED STRIPING IN EINKORN WHEAT AND ITS INHERITANCE. S. Matsumura (National Inst. of Genetics, Mishima, Japan). Wheat Inform. Serv. (Japan), Nos. 15-16, 1(Mar. 1963).

White and/or yellow stripes were observed and their mode of inheritance studied in Triticum monococcum flavescens, the seeds of which were exposed to x and γ rays, thermal and fast neutrons (14 Mev), or β rays from ^{32}P and ^{131}I solutions. (H.M.G.)

2153 BORON EFFECTS UPON GAMMA-RAY AND THERMAL NEUTRON IRRADIATIONS IN EINKORN WHEAT; RBE OF HEAVY PARTICLES FROM $^{10}B(n,a)^7Li$ REACTION. S. Matsumura, S. Kondo, and T. Mabuchi (National Inst. of Genetics, Misima, Japan). Wheat Inform. Serv. (Japan), Nos. 15-16, 2-3(Mar. 1963).

Chromosomal aberrations were investigated in Triticum monococcum flavescens. Seeds soaked in borax solutions were exposed to ^{60}Co γ rays or thermal neutrons. The frequency of aberrations increased markedly with dose increase for both γ rays and thermal neutrons and with increasing borax concentrations for the neutron treatments. The RBE doses for chromosomal aberrations and chlorophyll mutations under various irradiation conditions were calculated from frequency-dose curves drawn for neutron treatments. RBE values were found to be of the same order as those for fast neutrons previously reported for wheat and barley. (H.M.G.)

2154 DENSE-EARED MUTANTS DERIVED FROM X-RAY INDUCED LAX-EARED WHEAT. I. Uchikawa (Ehime Univ., Matsuyama, Japan). Wheat Inform. Serv. (Japan), Nos. 15-16, 10-13(Mar. 1963).

Two new cytogenetic types of dense-eared mutants were found in the progeny of x-ray induced lax-eared wheat mutants with 41 chromosomes. Origin of the new types is postulated. (H.M.G.)

2155 DIFFERENTIAL RADIO-SENSITIVITY AMONG THE DIFFERENT VARIETIES OF BREAD WHEATS. R. P. Chandola and M. P. Bhatnagar (Agriculture Dept., Jaipur, India). Wheat Inform. Serv. (Japan), Nos. 15-16, 13-14 (Mar. 1963).

Seeds of hexaploid and tetraploid wheat varieties were exposed to various doses of γ rays (10,000, 20,000, or 30,000 R). Yield and mutation determinations were made on progeny. Radiosensitivity was shown to depend on the number and kind of genomes as well as the kind of alleles present in any given variety. (H.M.G.)

2156 TRANSPLANTATION OF RAT BONE MARROW IN IRRADIATED MICE: EFFECT OF EXPOSURE RATE. Nazareth Gengozian (Oak Ridge Inst. of Nuclear Studies, Tenn.). Science, 146: 663-4(Oct. 30, 1964).

Mice were irradiated at several different exposure rates so that they received a total of 900 roentgens over the whole body. Within 2 hours they were injected with rat bone marrow. The success of the transplantation depended upon the rate at which the animals had been irradiated: the higher the rate, the greater the success of the grafts. Failure of grafts in mice subjected to low exposure-rates was associated with antibody formation. The data indicate existence of an immune mechanism which is dependent on the radiation exposure-rate. (auth)

2157 PROTON TUNNELING IN RADIATION-INDUCED MUTATION. Robert Rein and Frank E. Harris (Uppsala Univ.). Science, 146: 649-50(Oct. 30, 1964).

The equilibrium proton distribution and tunneling rate in the N–H...N hydrogen bond of the guanine-cytosine base pair were calculated quantum mechanically for the ground state, a charge-transfer excited state, and positive and negative ionic states. These results are consistent with the idea that tautomeric rearrangement can be a cause of radiation-induced mutation or carcinogenesis. (auth)

2158 β-GALACTOSIDASE: INACTIVATION OF ITS MESSENGER RNA BY ULTRAVIOLET IRRADIATION. P. A. Swenson and R. B Setlow (Oak Ridge National Lab., Tenn.). Science, 146: 791-4(Nov. 6, 1964).

A brief exposure of Escherichia coli cells to an inducer for β-galactosidase results in the production of a messenger RNA which subsequently expresses itself as β-galactosidase. Ultraviolet irradiation of cells after exposure to the inducer results in a decrease in the amount of β-galactosidase formed. The messenger RNA formed during the brief exposure to inducer is evidently inactivated by the ultraviolet radiation. The decay of messenger RNA activity in irradiated cells has the same kinetics as that observed in unirradiated cells. (auth)

2159 RADIOBIOLOGICAL MECHANISMS: COMPARATIVE DISTRIBUTION AND ROLE OF IONIZATION, EXCITATION, AND ENERGY AND CHARGE MIGRATION. L. G. Augenstein (Brookhaven National Lab., Upton, N. Y.). p.1-58 of "Progress in Biophysics. Vol. 13." New York, Pergamon Press, 1963.

Factors affecting the transfer of energy from incident radiation to biological material, observations suggesting the occurrence of non-random disposition of absorbed energy; and molecular modifications which can result in enzyme inactivation are described. Energy requirements for

enzyme inactivation are estimated. Mechanisms of excitation energy transfer and charge migration in biological systems are discussed, and possible processes in aqueous systems which might account for non-random localization of radiation effects are considered. Discussions are restricted primarily to effects of x and γ rays so as to minimize complications arising from the simultaneous occurrence of multiple excitation events in a single structure. (H.M.G.)

2160 THE EMPLOYMENT OF IONIZING RADIATION FOR THE GENETIC IMPROVEMENT OF FRUIT TREES. Gian Tommaso Scarascia-Mugnozza. p.47-71 of "Progresso Agricolo e Scienze Nucleari." Florence, Officine Grafiche Vallecchi, 1963. (RT/B10(63)41). (In Italian)

An analysis of the phenomenon of spontaneous bud mutation, both from a strictly genetic standpoint and from the contribution to the genetic improvement of vegetative propagation, takes into consideration the means for the experimental induction of bud mutations in different species of fruit trees: apple, pear, peach, cherry, plum, citrus plants, grape and black currant. The paper deals mainly with the description of the mutagenic agents used, the treatment technique adopted and the breeding methods of the materials experimented with the purpose of increasing the frequency of induced mutations. The results of practical interest already achieved are also discussed. (auth)

2161 USE OF RADIATION AND CHEMICAL MUTAGENS IN THE PRODUCTION OF MUTATIONS IN A CROP OF CONSIDERABLE INTEREST TO MEDITERRANEAN AGRICULTURE: DURUM WHEAT. G. T. Scarascia-Mugnozza, F. D'Amato, S. Avanzi, M. L. Belli, A. Bozzini, T. Vervigni, G. Martini, L. M. Monti, and C. Mosconi (National Committee for Nuclear Energy, Rome). p.353-61 of "Science et Technique pour les Regions peu Developpees." Rome, Consiglio Nazionale delle Ricerche, 1963. (RT/B10(63)45).

A program on experimental mutagenesis in Triticum durum is reviewed. Mutations induced by x rays, thermal neutrons, fast neutrons, ethyl methyl sulfonate, and diethyl sulfate are analyzed. Results indicate that in T. durum induced mutations often occur in association with chromosome structural changes. Mutant lines were evaluated agronomically. (H.M.G.)

2162 SUBCELLULAR MECHANISMS AND BIOPHYSICAL INDICATORS OF RADIATION-INDUCED INJURY. Philip B. Hollander (Radio Corp. of America, Princeton, N. J.). 13p. (CONF-522-2)

From Annual Meeting of the Aerospace Medical Association, Miami, Fla., May 1964.

Radioinduced subcellular changes are considered in relation to biological detection of low radiation levels. Recent work has utilized the biological organism as both the detector and the indicator work following two interrelated but distinct lines of investigation is reviewed: that of animal behavior or psychophysiology and that of electrophysiology or biophysics. The behavioral experiments demonstrate that low radiation doses can act as unconditioned stimuli in the conditioning of avoidance responses; whereas the electrocardiogram, electroencephalogram, or electroretinogram is used to measure the first measurable extracellular manifestation of a change in the internal environment of intact cells, a change in the cellular membrane potential. (H.M.G.)

2163 EFFECT OF STORAGE AT AMBIENT TEMPERATURE ON THE VOLATILE COMPONENTS OF IRRADIATED BEEF. E. L. Wick, M. Koshika, and J. Mizutani (Massachusetts Inst. of Tech., Cambridge). 25p. (CONF-639-3).

From 24th Annual Meeting of the Institute of Food Technologists, Washington, D. C., May 1964.

Volatile components of beef irradiated at 5 megarad by concurrent radiation-distillation, by radiation just prior to distillation, and by radiation and storage at ambient temperature for 6 months before distillation were isolated and characterized. The total yield of odor isolate from stored beef was approximately 4.4 mg per lb (about 10 ppm), or about one-third of the yield obtained from freshly irradiated beef or from nonirradiated beef. The n-alkanols and methional, major volatile components of freshly irradiated beef, are minor components of stored irradiated beef. n-Alkanols are present in relatively greater amount in order concentrates of stored beef. n-Alkanes and 1-alkenes are volatile components of both stored and freshly irradiated beef but are present in much smaller quantity in the stored product. (auth)

Radiation Effects Therapy and Countermeasures

2164 (ORNL-3700(p.155-6)) CHEMICAL PROTECTION AND ENZYME CATALYSIS. (Oak Ridge National Lab., Tenn.).

Reaction mechanisms involved in the protective effects of a mixture of AET and glutathione against neutron radiation injuries in mice are discussed. Several peptides closely related to glutathione were synthesized for use in testing of their radioprotective effects in mice. (C.H.)

2165 DOSE-SURVIVAL TIME RELATIONSHIP AND PROTECTIVE ACTION OF RESERPINE AGAINST X-IRRADIATION IN THE FISH, ORYZIAS LATIPES. Nobuo Egami and Hisami Etoh (National Inst. of Radiological Sciences, Chiba, Japan). Annotationes Zool. Japon., 35: 188-98(Dec. 1962).

Adults of the red variety of the teleost fish, Oryzias latipes, were irradiated with various doses of x rays (250 to 128,000 R). Survival times of irradiated fishes were recorded and the dose-survival time relationship was studied. From graphs constructed on the basis of these observations, four dose ranges which might have different kinds of effects on the fish were distinguished. If fishes were kept in water containing reserpine (100 mg/liter) before and during irradiation, the lethal effect of x rays was greatly weakened. (auth)

2166 COMBINED APPLICATION OF BICILLIN, DEHYDROSTREPTOMYCIN AND OXYTETRACYCLINE IN THE TREATMENT OF ACUTE RADIATION SICKNESS. M. Ya. Chaikovskaya and G. E. Vaisberg. Antibiotiki, 5: No. 3, 36-8(1960). (In Russian)

Dogs which had been subjected to x irradiation at a dose of 500 R received intramuscular bicillin and dehydrostreptomycin once every three days; within these intervals they were given oxytetracycline and dehydrostreptomycin perorally. The regimen tested reduced the symptoms of radiation sickness slightly. (C.H.)

2167 EFFECT OF AMINO ACID COMPOSITION ON RADIORESISTANCE OF PROTEINS. Alessandro Checcucci, Joseph Depireux, and Jules Duchesne (Université, Liège and Institut d'Astrophysique, Cointe-Selessin, Belg.). Compt. Rend., 259: 1585-7(Aug. 24, 1964). (In French)

It was shown that the radioresistance of some typical proteins, measured by electron spin resonance, evolves parallel with their contents in aromatic amino acids. The existence of a particularly low radioresistance in basic proteins, such as salmine and histone, was established. It was caused by the presence of diamine acids. (tr-auth)

2168 EFFECTS OF CERTAIN PURINE AND PYRIMIDINE BASES ON INDUCTION OF LYSIS CAUSED BY IRRADIATION OF CULTURES OF LYSOGENIC ESCHERICHIA COLI BY ULTRAVIOLET RADIATION AND ELECTRONIC ASPECTS OF THIS EFFECT. Michel Faguet (Institut Pasteur, Paris). Compt. Rend., 259: 1672-5(Aug. 31, 1964). (In French)

The protective effects of adenine, cytosine, and thymine against lysis induction in cultures of E. coli by uv radiation were evaluated. The variation of the protective effect with the electron resonance energy of the bases and their absorption for 2537-Å radiation was also studied. (D.C.W.)

2169 RELATION BETWEEN MORTALITY OF IRRADIATED MICE AND THE TIME DELAY BETWEEN X IRRADIATION AND INJECTION OF RESTORATIVE CELLS. J. F. Duplan and E. Estienne (Institut du Radium, Paris). Compt. Rend. Soc. Biol., 158: 666-70(1964). (In French)

Mice, approximately 70 days old, were exposed to x rays at a dose of 850 R. Restorative cells, either bone marrow of isologous mice or fetal liver removed on the 13th day of gestation, were injected at different times after irradiation: 72, 96, 120, and 144 hrs for fetal liver cells and 96, 120, 144, and 168 hrs for bone marrow cells. The results show that the percentage of survival decreases regularly with increased delay between irradiation and injection of restorative cells. The fetal liver cells behave differently from the medullary cells. With fetal liver cells the mortality begins to increase with a 3-day delay, but with the bone marrow cells, a 4-day delay is necessary. Both substances give the same survival curve, but the bone marrow curve is displaced 24 hrs. (J.S.R.)

2170 THE NUCLEIC ACID CONTENT IN ESCHERICHIA COLI OF VARYING RADIORESISTANCE. V. D. Zhestyanikov (Inst. of Cytology, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 157: 975-8(Aug. 1, 1964). (In Russian)

The relation between radio-resistance and nucleic acid content was investigated in E. coli B, B/g, and K12 and in different variants that are resistant to various antibiotics such as penicillin and streptomycin. A total of 22 variants were tested. The experiments were carried out on 18-hour cultures in a stationary phase of growth. The sensitivity to x rays (DL_{99}) was determined from exponential dose survival curves. The DNA and RNA contents per cell were calculated. The results showed that an increase in radioresistance is accompanied by an increase in DNA and RNA contents. This correlation was maintained, even when the radio-resistance was determined at a different temperature of post-irradiation growth of the bacteria. The ratio of RNA to DNA, which characterized the intensity of exchange processes in the microörganisms, could not be correlated with the radio-resistance. It was found that the product of the DNA × RNA concentrations reflects the relation between the radio-resistance and the nucleic acid content in the cell. (TTT)

2171 THE RADIATION BREAKDOWN OF DNA AS AN EXPERIMENTAL MODEL IN EVALUATING THE EFFICIENCY OF RADIOPROTECTIVE SUBSTANCES. K. E. Kruglyakova, N. V. Nikolaeva, N. A. Zakharova, and N. M. Emanuel (Inst. of Chemical Physics, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 157: 979-81(Aug. 1, 1964). (In Russian)

The viscosity of an aqueous DNA solution decreased sharply on being irradiated with ionizing radiation. If the DNA molecule was damaged by the formation of free radicals, the use of radical inhibitors could protect DNA from damage by radiation. The radioprotective properties of derivatives of gallic acid, phenylethylamine, and 3-hydroxypyridine were estimated from the relative change in viscosity of a DNA solution irradiated in the presence of the inhibitor and in its absence. A 0.04 to 0.08% DNA solution in a buffer of 0.2M NaCl + 0.015M sodium citrate at a pH of 6.4 was given an x-ray dose of 60,000 r at a rate of 2560 r/min. Protection of 60 to 100% was obtained on adding the radical inhibitor to the solution before irradiation. Derivatives of gallic acid and of 3-hydroxypyridine afforded some protection when added after the irradiation. A linear relationship was found between the percent protection of DNA from radiation damage and the antiradical activity of the inhibitor. (TTT)

2172 THE ROLE OF PURINE AND PYRIMIDINE BASES AND THEIR ANALOGUES IN RADIATION SENSITIVITY. Henry S. Kaplan, John D. Earle, and F. L. Howsden (Stanford Univ., Palo Alto, Calif.). J. Cellular Comp. Physiol., 64: Suppl. 1, 69-89(Oct. 1964).

The sensitivity of bacterial species to the lethal effects of radiations and alkylating agents is related to the base composition of their DNA; high guanine and cytosine (GC) content confers increased sensitivity to x rays and mustards and increased resistance to ultraviolet. Preliminary results suggest that differences in average GC content of different markers in Bacillus subtilis DNA may be detectable by radiosensitivity analysis. Purine starvation, thymine starvation, or incubation with certain purine and pyrimidine analogues may alter bacterial radiation responsiveness, as reflected in changes in the slope and/or shoulder of dose-survival curves; the responses differ characteristically with respect to such parameters as time of onset, reversibility, relative expression with x rays versus ultraviolet, oxygen-dependence, and glycerol-dependence. Available evidence pertaining to the molecular mechanisms of these radiosensitization phenomena is reviewed. (auth)

2173 PELOIDIN TREATMENT OF RADIATION INJURIES OF THE SKIN. Yu. I. Karibov and N. P. Mordvinova (Research Inst. of Roentgen-Radiology, Ministry of Public Health, USSR). Med. Radiol., 9: No. 9, 27-9(Sept. 1964). (In Russian)

Peloidin, (an extract of curative salt), was used for the treatment of 40 patients suffering from radiation injuries of the skin. In 33 patients radiation injuries of the skin developed after radium therapy for malignant neoplasms, and in 7 for other neoplastic diseases. In exudative epidermitis the use of peloidin in the form of fomentation accelerates the process of epithelization. In ulcer the base is irrigated with peloidin and plugged with tampons. The authors observed that dressings with peloidin applied to patients suffering from radiation ulcers of the skin alleviate the pain and accelerate the process of epithelization in several days. Peloidin is an effective remedy for removing necrotic and purulent matter from the surface of radiation ulcers. (auth)

2174 THE PROTECTIVE ACTION OF HYPOTHERMIA DURING AFFECTION BY IONIZING RADIATION. G. N. Ilyutkin and L. P. Dymnikova (Pavlov Inst. of Physiology, Academy of Sciences, USSR and Kirov Military Medical Academy, USSR). Med. Radiol., 9: No. 9, 46-51(Sept. 1964). (In Russian)

The protective action of hypothermia was studied in ionizing radiation affection. The experiments were performed on dogs and rats. The body temperature was reduced to 22 to 25°C (dogs) and 15 to 17°C (rats). The animals were subjected to x irradiation in a dose of 350 to 600 R after the present body temperature was achieved, the state of hypothermia being maintained for a period of 1 to 24 hrs. The results of the investigations show that radiation sickness in animals irradiated in a state of hypothermia runs a milder course. The more prolonged was the state of hypothermia in animals after irradiation, the less marked was an injurious action of ionizing radiation. (auth)

2175 THE PROPHYLACTIC EFFECT OF MERCAMINE IN RADIATION INJURIES OF GROWING ANIMALS. T. V. Fokina (Inst. of Pediatrics, Medical Academy of Sciences, USSR). Med. Radiol., 9: No. 9, 51-4(Sept. 1964). (In Russian)

Investigations of the comparative effectiveness of the protective action of mercamine in different animals at various stages of postnatal ontogenesis following x-ray irradiation in doses of 500 and 1,000 R are reported. Experiments were carried out in two age-groups of rats. Irradiation in the first group was started at the age of three days, in the second group at the age of one month. (auth)

2176 WAYS AND MEANS OF SUPPRESSING THE AUTOIMMUNE REACTION OF THE IRRADIATED ORGANISM. N. N. Klemparskaya. Med. Radiol., 9: No. 9, 54-60(Sept. 1964). (In Russian)

A critical analysis is presented of works published during the last eight years concerned with the influence

of prophylactic inoculations on the radioresistance of the organism. Note is made of the type of the antigen, the value of the interval between the inoculation and irradiation, the importance of the vaccine dose and irradiation dose, and other conditions. The possible mechanisms governing this phenomenon are discussed. (auth)

2177 NORMALIZATION OF THE IMMUNOGENESIS DISTURBED BY THE EFFECT OF IONIZING RADIATION. P. N. Kiselev and V. A. Semina (Central Research Inst. of Roentgen-Radiology, Ministry of Public Health, USSR). Med. Radiol., 9: No. 9, 61-7(Sept. 1964). (In Russian)

Experimental data concerned with studies of the action of different substances on the stimulation of immunogenesis in rabbits, rats and albino mice disturbed by total x-ray irradiation (400 R) are discussed. Satisfactory results of immunogenesis normalization were obtained by administration to animals of somatotropic hormone, cysteine hydrochloride, and the serum factor obtained from the blood of revaccinated animals. Possible trends in the further study of this problem are outlined. (auth)

2178 IMMUNIZATION AS A MEANS OF BIOLOGICAL PROTECTION OF THE ORGANISM FROM IONIZING RADIATION. M. I. Ravich-Shcherbo and L. G. Prokopenko (Kursk Medical Inst., USSR). Med. Radiol., 9: No. 9, 75-80(Sept. 1964). (In Russian)

Preliminary immunization with one antigen stimulates sharply the formation of antibodies to another antigen introduced after irradiation in comparison with animals irradiated without preliminary immunization. Preliminary immunization is also conducive to a milder course of radiation sickness (a lesser weight loss and leukopenia). The protective action of preliminary immunization in respect to antibody synthesis is manifested locally, primarily in the lymph nodes producing antibodies to the antigen administered before irradiation. The general non-specific favorable action of preliminary immunization becomes manifest only after two or three injections of the antigen. (auth)

2179 EFFECT OF CHEMICAL PROTECTIVE AGENTS (CYSTEAMINE AND β-AMINOETHYLISOTHIURONIUM (AET) Cl HCl) AND HOMOLOGOUS TESTES-DNA ON THE DEATH-RATE OF THE PROGENY OF A FIRST GENERATION ORIGINATING FROM MALE RATS IRRADIATED IN THE INFANTILE PERIOD. N. Savković (Inst. of Nuclear Sciences "Boris Kidrich," Belgrade). Nature, 203: 1393(Sept. 26, 1964).

The death rate was observed in progeny of male rats x-irradiated (600 R) during infancy. Animals were divided into four groups: irradiated; AET-treated prior to irradiation; cysteamine-treated prior to irradiation; and treated with homologous testes-DNA after irradiation. As previously shown, irradiation caused death of the progeny. The death rate was higher in animals treated with cysteamine prior to irradiation and was only slightly lower in the AET-treated group than the irradiated controls. However, testes-DNA reduced the percentage of deaths to values closer to the non-irradiated control group. Evidence indicated that neither cysteamine nor AET prevented the occurrence of mutations. (H.M.G.)

2180 FACTORS INFLUENCING THE RADIOPROTECTION OF TISSUE CULTURE CELLS BY SULPHYDRYL COMPOUNDS. A. J. Vergroesen, L. Budke, and J. A. Cohen (National Defence Research Organization T.N.O., Rijswijk, Netherlands). Nature, 204: 246-7 (Oct. 17, 1964).

The hypothesis that not the concentration of $-SH$ groups but that of their dissociated form, the $-S^-$ ions, might be responsible for protection against radiation was tested in x-irradiated cultures of human kidney cells. Results indicated a correlation between the radioprotective action of the sulphydryl compounds and the extent of their dissociation in the medium. The concentration of the $-S^-$ ion thus depends on the pK value of the sulphhydryl compound, the concentration of the compound; and the pH of the medium. (H.M.G.)

2181 CHEMICAL PROTECTION AGAINST REPEATED SUPRALETHAL DOSES OF IONIZING RADIATION IN MICE. Richard I. H. Wang and Jack Ballantyne (Roswell Park Memorial Inst., Buffalo, N. Y. and New York State Dept. of Health, Springville). Radiation Res., 23: 369-76 (Nov. 1964).

When a mixture of three radioprotective chemicals (2 μM of serotonin, 7 μM of AET, and 25 μM of MEA) was given to mice intraperitoneally 10 minutes before a first radiation exposure of 800, 1100, or 1400 R, 95, 92, and 50% of the animals, respectively, remained alive. On the thirty-sixth day after the first radiation exposure, these surviving mice were given the same chemical mixture and the same radiation exposure of 800, 1100, or 1400 R. It was found that 97, 93, and 77% of these animals, respectively, survived the second radiation exposure. In spite of the occurrence of a 9% toxicity due to the administration of two doses of the chemical mixture, the total mortalities (combined radiation and drug mortalities) were 14.3, 22.8, or 67.2% for those groups of mice receiving two equal doses of 800, 1100, or 1400 R, respectively. It is concluded that a high degree of chemical protection against repeated supralethal doses of x-irradiation in mice can be achieved when an interval is allowed for tissue recovery between the two irradiations. (auth)

2182 EFFECT OF 2-MERCAPTOETHYLAMINE ON THE PEROXIDATION IN MICROSOMES OF UNSATURATED LIPIDS CATALYZED BY CYSTEINE OR THIOLACTIC ACID AND ULTRAVIOLET LIGHT. Frederick Bernheim (Duke Univ., Durham, N. C.). Radiation Res., 23: 454-60 (Nov. 1964).

The oxidation of unsaturated lipid in rat liver microsomes is catalyzed by cysteine or thiolactic acid. The catalysis is increased by the addition of iron or copper salts and by exposure to ultraviolet light. 2-Mercaptoethylamine inhibits the catalysis under all these conditions. (auth)

Radiation Hazards and Protection

2183 (HW-SA-3730) PLUTONIUM ABSORPTION—EVALUATION AND TREATMENT. P. A. Fuqua (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 30, 1964. Contract AT(45-1)-1350. 7p. (CONF-798-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Annual AEC and Contractor Health Protection Meeting, Los Angeles, Oct. 1964.

The radiotoxicity of plutonium is such that near zero retention and absorption in the body is desirable. The most common absorption source is from contaminated wounds. The most common treatment of these wounds is early excision of the entire wound. Absorption sites not surgically accessible are treated with intravenous DTPA. Some of the most urgent diagnostic needs are described. It is pointed out that, while much progress has been made in the evaluation and treatment of plutonium absorption, many unknowns remain which require solution for more effective treatment. (auth)

2184 (LA-DC-6681) METHODS IN THE EVALUATION OF RADIATION HAZARDS IN MANNED SPACE FLIGHT. Douglas Grahn (Argonne National Lab., Ill.); and Wright H. Langham (Los Alamos Scientific Lab., N. Mex.). [1964]. Contract W-7405-eng-36. 14p. (CONF-720-2). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 2nd Symposium on Protection Against Radiation Hazards in Space, Gatlinburg, Tenn., Oct. 1964.

The criteria for new standards for permissible radiation dose during space flight are reviewed. It is recommended that the radiation hazards be evaluated in terms of immediate or early incapacitation at any time during flight, progressive incapacitation or serious decrementation of performance over long flight periods; delayed or chronic injury as it may require intervention in a planned

flight series, and as a career limitation factor. The clinical manifestations associated with each of these conditions are reviewed in terms of radiation dose. It is pointed out that the prediction of man's response is difficult under controlled conditions and that it is impossible for the erratic pattern of radiation exposure, weightlessness, stress, and other factors that may accrue from prolonged periods of demand for high operating performance. (C.H.)

2185 (LFEN-NI-17) O PROBLEMA DA RADIOACTIVIDADE NA EXPLORACAO E TRATAMENTO DE MINERIOS DE URANIO. (Problems of Radioactivity in Exploration and Processing in Uranium Mines). Augusto Jorge Ribeiro da Fonseca (Portugal). Junta de Energia Nuclear. Laboratorio de Fisica e Engenharia Nucleares, Sacavem). 1964. 40p. Dep.(mn).

The high incidence of lung carcinoma in workers of Schneeberg and Joachimsthal mines has first drawn attention to the probable carcinogenic effects of radon and daughters, present in high concentrations in the atmosphere of those mines. Since then, it has been generally accepted that heavy alpha emitters can be responsible for the incidence of several types of professional lung diseases. Cummulative to an external radiation dose, workers engaged in mining and milling of nuclear ores can be affected, mainly at respiratory tract, by the inhalation of radon and dustborne uranium and radon daughters. It is, therefore, of greatest importance that risks be evaluated through measurement of different physical parameters and, afterwards, all possible efforts be carried out to reduce concentrations of radioactive elements in air to values under maximum permissible levels. (auth)

2186 RADIOACTIVE CONTAMINATION OF THE HUMAN DIET AND OF MAN. John H. Harley (U. S. Atomic Energy Commission, New York). Arch. Environ. Health, 9: 649-53(Nov. 1964).

Contributions of fallout to the radionuclide content of the human diet are considered, with emphasis on ^{90}Sr, ^{137}Cs, ^{131}I, and ^{226}Ra. Dietary intakes of ^{90}Sr are compared for New York, Chicago, and San Francisco. (H.M.G.)

2187 DECONTAMINATION METHODS FOR RADIOACTIVE WATERS. Olli Paakkola (Institut für Strahlenphysik, Helsinki). Foederation Europaeischer Gewaesserschutz, Informationsbl., No. 10, 66-8(May 1964). (In German)

Decontamination of waterworks after reactor breakdown or a nuclear explosion is discussed. The first phase consists in the dilution of contaminated water with normal water. The flow of water allows processes such as precipitation, coagulation, or fixation of active substances in aquatic organisms and in sludge. Soft surface waters with a large humus content were found to be easy to rid of cesium, whereas strontium was more easily removed from hard ground water. The main decontamination methods are coagulation, flocculation, ion exchange, evaporation, and distillation. (M.C.G.)

2188 PROBLEMS OF RADIOACTIVE DRINKING WATERS IN CISTERNS AND THEIR SOLUTIONS. M. M. Bezzegh (Eidgenossisches Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, Zurich). Foederation Europaeischer Gewaesserschutz, Informationsbl., No. 10, 69-72(May 1964). (In German)

Activity monitoring was conducted on cistern water samples taken from the Jura Hills. This water is used for drinking without any processing. The maximum permissible concentration in drinking water for a small group of population and for beta emitters was repeatedly exceeded. Experiments using peat were carried out to determine decontamination factors. A filtration apparatus for rainwater cisterns was built. Peat was found to be well suited to decontamination of rain water. (M.C.G.)

2189 EFFECT OF LOW RADIATION INTENSITIES ON MAN. F. J. Jankowski (Rutgers Univ., New Brunswick, N. J.). Trans. Am. Nucl. Soc., 7: 534-5(Nov. 1964).

2190 SPACE DOSIMETRY. George W. Crawford (Southern Methodist Univ., Dallas). p.705-41 of "Space Physics." New York, John Wiley & Sons, 1964.

Techniques are given for calculating, separately or collectively, the radiation doses produced in spacecraft by cosmic nucleons, electrons, and photons. Methods for measuring the dose are also summarized. The doses absorbed by various parts of the body (e.g., at the waist at depths of 0 to 8 cm beneath the skin) are calculated. 53 references. (T.F.H.)

Radiotherapy and Radiodiagnosis

2191 (ORNL-P-658) DEVELOPMENT OF INSTRUMENTATION FOR NUCLEAR MEDICINE. D. A. Ross, C. C. Harris, M. M. Satterfield, and P. R. Bell (Oak Ridge National Lab., Tenn.). [1963]. Contract W-7405-eng-26. 40p. (CONF-800-1). Dep.(mn); $2.00(cy), 1(mn) OTS.

From 6th Japan Conference on Radioisotopes, Tokyo, Nov. 1964.

Recent developments in the design of instruments for use in nuclear medicine are discussed. Emphasis is placed on instruments that reduce the radiation dose to the patient, instruments for low-activity counting, instruments for scanning with shorter times, and devices to facilitate interpretation of results. (C.H.)

2192 PROBLEMS OF RADIATION PROTECTION IN THERAPY WITH RADIOGOLD SEEDS (Au^{198}). Hermann Kapp-Schwoerer and Evamaria Malsch (Universitäts-Frauenklinik, Freiburg i. B). Nucl. -Med., 4: 134-45 (Jan. 10, 1964). (In German)

In certain types of therapy radiogold seeds (^{198}Au) are gaining importance and the requirements of radiation protection during their use are discussed. The situation was carefully studied by measurements with phantoms, model walls, and in ward rooms. It is demonstrated that after application of the usual therapeutic quantities the patients can be placed in ward rooms having brick walls of at least 25 cm thickness, without other special shielding measures, provided that a lead screen is placed at the height of the radiation sources and that the nursing staff obeys the code of practice of the Regulation. There is no need to restrict the number of persons or their stay in the adjacent ward rooms. The use of radiogold seeds as an additional radiotherapeutic measure appears to be permissible in smaller hospitals. (auth)

2193 A CODE OF PRACTICE FOR THE DOSIMETRY OF 2 TO 8 Mv X-RAY AND CESIUM-137 AND COBALT-60 γ-RAY BEAMS. Phys. Med. Biol., 9: 457-63(Oct. 1964).

A code of practice is presented for the dosimetry of 2 to 8 megavoltage, x-ray, telecobalt, and telecesium radiotherapy units. The code was developed by a subcommittee of the Hospital Physicists' Association. (C.H.)

2194 THE COMPUTATION OF SINGLE AND MULTIPLE FIELD DEPTH DOSES FOR 4 Mv X-RAYS. C. S. Hope and Judith H. Walters (Western Regional Hospital Board, Glasgow). Phys. Med. Biol., 9: 517-19(Oct. 1964).

A method is outlined for using a computer to calculate the dose in a patient from either single or multiple fields from a 4 Mv linear accelerator. (auth)

2195 THE USE OF A COMPUTER TO CALCULATE ISODOSE INFORMATION SURROUNDING DISTRIBUTED GYNAECOLOGICAL RADIUM SOURCES. Gail D. Adams and Mary L. Meurk (Univ. of California, San Francisco). Phys. Med. Biol., 9: 533-40(Oct. 1964).

A program was written for the production of dosage information around multiple radium sources in arrays similar to those found in gynecological situations. The arrangement of the sources is measured on anteroposterior and lateral radiographs and is transferred to the computer (IBM 1620) along with other pertinent information for the numerical work by means of punch

cards. The output may take the form of a tabular listing of co-ordinate points and corresponding dose rates, or of a plot containing isodose information. Any plane (at 1 mm intervals) parallel to either of the source radiographs may be chosen for plotting, and successive choices of planes for a given patient are easily made. (auth)

2196 MEASUREMENT OF THE MODULATION TRANSFER FUNCTION OF RADIOGRAPHIC SYSTEMS CONTAINING FLUORESCENT SCREENS. K. Rossmann (Eastman Kodak Co., Rochester, N. Y.). Phys. Med. Biol., 9: 551-7(Oct. 1964).

Experimental and theoretical considerations indicate that the simplest method of obtaining the modulation transfer function of screen-film systems are by calculation from the measured line spread-function. However, care must be taken, since the sweeping tails of the line spread-function and the presence of development effects can introduce a considerable error in the transfer function calculation. An experimental method involving a narrow slit is described. Results are shown for three typical screen-film systems having different resolutions. (auth)

2197 THE USE OF A 70-Mev SYNCHROTRON IN CANCER THERAPY. I. PHYSICAL ASPECTS. Gail D. Adams (Univ. of California, San Francisco). Radiology, 83: 785-96(Nov. 1964).

A 70-Mev synchrotron was used as a source of 70-Mv x-rays for the treatment of patients with cancer. Some engineering aspects and operating characteristics of the synchrotron are discussed. Typical isodose charts are displayed, and some remarks on their use in planning treatments are included. (auth)

2198 THE USE OF A 70-Mev SYNCHROTRON IN CANCER THERAPY. II. CLINICAL ASPECTS. Robert S. Stone and Rose V. Louie (Univ. of California, San Francisco). Radiology, 83: 797-806(Nov. 1964).

The synchrotron producing a 70-Mv beam of x-rays has proved a satisfactory and useful unit for treating patients with cancer. The main advantages stem from the facts that the maximum absorbed dose is about 10 cm deep in the patient, and that a usefully high dose extends over several centimeters in depth. This allows treatments to be given by simple single-field or opposing double-field technics, which make the daily set-up of patients easy and accurate and result in a uniform dose throughout the tumor at each session. The integral dose was low for any given tumor dose, resulting in few general systemic reactions. Any desired dose was delivered to any lesion, no matter how stout the patient. Most of the patients accepted during the past seven years had advanced disease or some serious complication, or both. The number of patients treated for any one type of carcinoma was small. The period of observation was short. It is possible, however, to report on one-year survival in the larger groups, as follows: uninary bladder, 63 per cent of 83 patients; uterine cervix, 68 per cent of 53 patients; and uterine corpus, 79 per cent of 19 patients. While it has not yet been demonstrated that any greater curative or palliative effects are to be obtained, the physical, technical, and clinical advantages of the 70-Mv beam of x-rays make it a useful tool, especially in the treatment of deep-seated cancer. (auth)

2199 EFFECT OF TOTAL-BODY IRRADIATION ON THE RESPONSE OF TRANSPLANTED MOUSE TUMORS TO FRACTIONATED LOCAL RADIOTHERAPY. II. DEVELOPMENT OF METASTASES. Melvin R. Sikov, Bettina B. Cook, and James E. Lofstrom (Wayne State Univ., Detroit). Radiology, 83: 807-15(Nov. 1964).

Mice bearing subcutaneous implants of the L-I lymphosarcoma or the Ehrlich carcinoma were subjected to multiple radiation exposures of the tumor. The radiation was administered over a range of fractionation patterns but within each experiment the overall time of exposure was kept constant. The responses obtained with local radiation were compared to those obtained when the local doses were reduced and replaced by the same amount of total-body irradiation. With the L-I lymphosarcoma, it was found that inclusion of the ipsilateral lymph nodes in the radiation field decreased the overall incidence of metastases and extensions of the primary tumor, delayed the time of their development, and altered their anatomic distribution. The overall incidence of metastases was decreased as the radiation was administered in fewer fractions and was further decreased by the administration of whole-body irradiation. Total-body exposure also suppressed proliferation in those metastases which did develop. The same general relation to the degree of fractionation was seen in the studies with the Ehrlich carcinoma, but the differences between groups were much smaller. Total-body irradiation did not affect the development of metastases of this tumor. (auth)

2200 ADJUVANT USE OF RADIOACTIVE COLLOIDS IN THE TREATMENT OF CARCINOMA OF THE OVARY. Margaret A. Holbrook, John S. Welch, and Donald S. Childs, Jr. (Mayo Clinic and Mayo Foundation, Rochester, Minn.). Radiology, 83: 888-91(Nov. 1964).

Selected patients with cancer of the ovary were treated postoperatively with ^{198}Au colloids injected directly into the peritoneal space. Of a group of 118 patients, 68 lived five years or more. Twenty of the 68 patients received additional external radiation therapy to the pelvic region, not exceeding 2,500 R. The prognosis in patients with malignant ovarian lesions is discussed and results of therapy are reported according to the classification of the tumor. (C.H.)

CHEMISTRY

General

Refer also to abstract 2907.

2201 (BNL-8221) ELECTROCHEMONUCLEAR FIXATION OF NITROGEN AND THE PRODUCTION OF INDUSTRIAL CHEMICALS. Meyer Steinberg (Brookhaven National Lab., Upton, N. Y.). July 1964. Contract AT(30-2)-GEN-16. 4p. (CONF-654-11). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

Electrochemonuclear processes involve the coupling of power reactors with electrochemical cells. In the application of such processes to the fixation of N_2, H_2 is produced from water in electrolytic cells and then reacted with N_2 separated from air, for the synthesis of NH_3 by the high-pressure thermocatalytic process. The economics of electrochemonuclear fixation of N_2 are studied, and it is found to compete favorably with coal and natural gas plants. Other advantages of electrochemonuclear processes are pointed out. (D.L.C.)

2202 (EUR-1895.d) TRENNUNG VON TERPHENYL-GEMISCHEN DURCH THERMODIFFUSION. (Separation of Terphenyl Mixtures by Thermal Diffusion). W. Haubold and W. Peppler (Internationale Atomreaktorbau G.m.b.H., Bensberg, Germany). 1964. 16p. Dep.(mn).

For a commercial-grade terphenyl mixture (2.7 wt % biphenyl, 19.4 wt % high boiler components), test performed in a thermal diffusion column disclosed an enrichment of biphenyl and p-terphenyl near the hot wall (270°C), while the high boilers and o-terphenyl concentrated near the cold wall (190°C). As a result of the migration of the dark colored high boiler components, brightening of the terphenyl mixture near the hot wall took place; this phenomenon was observed both during tests on the thermal diffusion column and in the course of microtests on a heated steel wire run through terphenyl. From the test results, the conclusion may be drawn that the fouling effect is attributable not to an enrichment of high molecular organic matter near the heat transfer surfaces, as caused by thermal diffusion. (auth)

2203 (EUR-1912.i) ESTRAZIONE DELL'URANIO ESAVALENTE DA SOLUZIONI ACQUOSE SOLFORICO-NITRICHE MEDIANTE TRILAURILAMMINA. (The Extraction of Hexavalent Uranium From Sulfuric–Nitric–Water Solutions by Trilaurylamine). F. Mannone and C. Stoppa (European Atomic Energy Community. Joint Nuclear Research Center, Ispra, Italy). 1964. 42p. Dep.(mn).

The extraction of uranium and nitrate ions from sulfuric–nitric acid solution by 20% trilaurylamine (TLA) in dodecane has been experimentally studied. The batch tests were performed using sulfuric-nitric solution in which the following parameters were alternatively varied: hydrogen-ion concentration; total anion concentration; and percentage of nitrate ions relative to total anions. Distribution data of uranium and nitrate ions at room temperature are reported. They show that: the uranium distribution coefficient, in the worst extraction conditions are not lower than 5×10^{-2}; the TLA nitrate is more stable than TLA sulfate and TLA-uranyl-sulfate; the uranium extraction from sulfuric-nitric acid solution by 20% trilaurylamine in dodecane can be best achieved if the starting solutions have low concentrations of hydrogen ions and total anions and a low percentage of nitrate ions. (auth)

2204 (NLCO-935) BLENDING OF UF_4 BY LINEAR PROGRAMMING TECHNIQUES. Rodney L. Irwin (National Lead Co. of Ohio, Cincinnati). Nov. 10-11, 1964. Contract AT(30-1)-1156. 16p. (CONF-816-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Midwest POOL Meeting, Chicago, Nov. 1964.

A problem frequently encountered in production control is that of material blending. A mathematical model based on linear programming techniques is presented which maximizes the utilization of low quality material in a blend. Error propagation is examined and a means of estimating blending error is given. The model is illustrated by a numerical example. (auth)

2205 (ORNL-TM-936) CHEMICAL TECHNOLOGY DIVISION, UNIT OPERATIONS SECTION MONTHLY PROGRESS REPORT, JUNE 1964. M. E. Whatley, P. A. Haas, R. W. Horton, A. D. Ryon, J. C. Suddath, and C. D. Watson (Oak Ridge National Lab., Tenn.). Nov. 1964. Contract W-7405-eng-26. 32p. Dep.(mn); $2.00(cy), 1(mn) OTS.

Studies in the Solvent Extraction program included scouting tests made with a small mixer-settler of novel design, intended for use with radioactive materials. It used overflow weirs to provide positive interface control in each stage, inclined settlers for high capacity, and used magnetically coupled pump mixers for high efficiency. Runs with both amine solvents and TBP were promising. In the Waste Processing program, Potcal run R-84 was terminated when a hole was melted in the 16-in. inductively heated waste calcination vessel. At no time in the test did the vessel thermocouples indicate temperatures over 900°C. The run, until the hole developed, proceeded well, following predicted performance. (auth)

2206 RADIOACTIVE SOURCES AND METHOD FOR MAKING. John P. Ryan (to Minnesota Mining and Mfg. Co.). U. S. Patent 3,147,225. Sept. 1, 1964. Filed Jan. 30, 1958.

A method is given for preparing weather-resistant refractory particles containing dispersed radioactive ions. The method comprises forming glass frit particles, leaching the acid-soluble nonrefractory constituents of the particles with an acid solution, placing the leached particles in solutions of radioactive ions, heating the particles to above 350°C to shrink the pores and thereby affix the radioactive ions within the pores, and washing the particles in acid water to remove ions from the outer surfaces. Several examples of the method are given. (D.L.C.)

Analytical Procedures

Refer also to abstract 3771.

2207 (CEA-R-2441) DETERMINATION DU TITRE ABSOLU DES MELANGES H_2O-D_2O PAR AUGMENTATION DE LA SENSIBILITE DES MESURES PAR ABSORPTION INFRA-ROUGE. (Determination of the Absolute Concentrations of H_2O-D_2O Mixtures Using the Increase in Sensitivity of Infrared Absorption Measurements). M. Ceccaldi (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). 1964. 14p. Dep.(mn).

A description is given of original work concerning an infrared method for determining the absolute isotopic content of H_2O-D_2O mixtures. The spectrum is obtained, in both the liquid and the solid states, of water of unknown D_2O content and of mixtures of this water and light water. The Beer-Lambert law is well followed in this case; the measurement of three parameters involved in this law is described together with a method of measuring the fourth parameter. The results obtained using infrared and nuclear resonance techniques are compared. The concentration of the 99.9960 per cent reference water is known with a precision of at least +40 ppm −20 ppm and very likely to be ±5 ppm. (auth)

2208 (CLOR-28) A SCINTILLATION METHOD FOR Rn-222 DETERMINATIONS. T. Wardaszko, J. Pensko,

and R. Szepke (Poland. Biuro Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej. Centralne Laboratorium Ochrony Radiologiczaej, Warsaw). 1964. 22p. Dep.

A device for assaying picocurie amounts of radon-222 in various media using alpha-scintillation technique is described. For this purpose a probe with internally ZnS-(Ag)-coated glass bulbs was developed. The scintillations being produced on their side walls are registered by a photomultiplier tube through a transparent window. Scintillation bulbs of 0.4 and 1.5 l of volume have been applied, giving a counting efficiency of 0.7 and 4 cpm/(pc/l) respectively, and detection limit of 0.3 pc (or 0.8 pc/l) and 2.5 pc (1.6 pc/l) respectively. Radon concentrations smaller than the above mentioned have been measured applying charcoal adsorption. Some results obtained for radon content in exhaled air and atmospheric air as well as Ra-226 determinations in urine and water using deemanation technique are given. (auth)

2209 (CRDC-1141) AN INFRARED METHOD FOR DETERMINING VARIATIONS IN THE DEUTERIUM CONTENT OF NATURAL WATER. J. G. Bayly, W. H. Stevens, and W. M. Thurston (Atomic Energy of Canada Ltd., Chalk River, Ont.). Jan. 1964. 13p. (AECL-2076). Dep.; $0.50(AECL).

A laboratory method of analysis for determining variations in the deuterium content of water near the natural concentration level (≈0.0148 at. %) is described. Concentration differences of 0.0002 at. % between two samples can be detected. The method was developed to test concepts for an improved on-stream monitor to detect leakage of heavy water into natural water in a heavy-water power reactor. (auth)

2210 (GEAP-4602) RESULTS OF THE USAEC ROUND-ROBIN ANALYSIS FOR CARBON IMPURITY IN SODIUM. R. W. Lockhart, R. C. Blair, D. Dutina, J. L. Jaech, and W. W. Sabol (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Mar. 1964. Contract AT(04-3)-189. 84p. Dep.(mn); $3.00(cy), 2(mn) OTS.

Several analytical methods appear to be capable of determining total carbon in sodium at levels above 10 ppm with moderately good precision. Apparent inhomogeneity of carbon in the sodium samples continues to be a problem. This factor may be significantly limiting the determination of the lower limit of detection and the precision and comparison of existing analytical methods. The results of two round-robin carbon analysis programs are reported. For both programs sodium samples were prepared for each participant of the program from a common source of sodium. Attempts to provide three levels of carbon impurity failed on both rounds. Chemical laboratories of reactor design groups, analytical laboratories, sodium producers, and national laboratories participated in this program to demonstrate the reliability of available analytical techniques for determining low levels of carbon impurity in sodium. The analytical results, methods of analysis, and procedure details were submitted to the authors for compilation, review, and evaluation. This program has indicated that considerable advances have been made in the available analytical methods for carbon analysis but that there is still a great deal of refinement needed in sodium source preparation and sampling and handling techniques. (auth)

2211 (HW-82624) MEASUREMENT OF BERYLLIUM ON AIR FILTERS. W. L. Bunch and W. G. Spear (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [1963]. Contract AT(45-1)-1350. 11p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The use of (α,n) reactions for determination of Be from air samples was investigated. ^{210}Po was used as the α source. It was found that an analytical system can be achieved if properly sealed and impurity-free ^{210}Po α sources become available. (J.R.D.)

2212 (IEA-72) ACTIVATION ANALYSIS APPLIED TO FORENSIC INVESTIGATION. SOME OBSERVATIONS ON THE PROBLEM OF INDIVIDUALIZATION OF HUMAN HAIR. F. W. Lima, H. Shibata, and L. T. Atalla (Brazil. Instituto de Energia Atomica, São Paulo). Oct. 1964. 24p. Dep.(mn).

Variation of concentration of inorganic elements along human hair's length is studied through the comparison of the gamma spectra of two samples of irradiated hair. Special attention is given to the influence of the growing cycle of the hair on its composition, as far as the inorganic elements are concerned. Comparison of composition of hairs from different parts of the body (head and pubic hair) is also made as well as of hairs at different times of their growing cycles. A discussion of how these facts can affect the problem of individualization is made. (auth)

2213 (JAERI-4028) ANALYTICAL CHEMISTRY OF PLUTONIUM — A BIBLIOGRAPHY. (Japan Atomic Energy Research Inst., Tokyo). Sept. 1964. 210p. Dep.(mn). (In Japanese and English)

A bibliography on the analytical chemistry of plutonium has been prepared. Approximately 1,500 reports and papers abstracted are on the basic properties, separation and determination of plutonium, separation and determination of impurities and minor constituents in plutonium, and health physics and biological aspects. The sources searched systematically were Nuclear Science Abstracts for the period of 1948 to 1963 (NSA, Vols. 1 to 17) and Chemical Abstracts for the period of 1945 to 1963 (CA, Vols. 39 to 59). Subject, author, and journal or report number are given, following the ways adopted in the above abstract journals. Besides the above items, annotation is also given in Japanese and the abstract numbers in the above abstract journals are also cited. In those papers in which the subjects of work are not given clearly in the subject titles, some words or phrases written in English, supplementing the subject titles in parentheses, are given at the end of the annotation. (auth)

2214 (NLCO-927) THE NEUTRON ACTIVATION FACILITY AT THE NATIONAL LEAD COMPANY OF OHIO. B. L. Twitty (National Lead Co. of Ohio, Cincinnati). Sept. 23, 1964. Contract AT(30-1)-1156. 18p. (CONF-790-2). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 14th Annual Analytical and Physical Testing Symposium, Cincinnati, Oct. 1964.

A new facility for neutron activation analysis has recently begun operation at the National Lead Company of Ohio. Neutrons produced in a Cockcroft-Walton-type accelerator are shot into a sample to be analyzed. Radiation which is induced in the sample is measured by a NaI(Tl) crystal coupled to either a dual-channel or a 400-channel pulse-height analyzer. (auth)

2215 (NLCO-928) THE DETERMINATION OF CARBON IN URANIUM AND THORIUM METAL BY THERMAL CONDUCTIVITY. J. D. Pope and J. R. Prall (National Lead Co. of Ohio, Cincinnati). Sept. 30, 1964. Contract AT(30-1)-1156. 18p. (CONF-790-3). Dep.(mn); $1.00 (cy), 1(mn) OTS.

From 14th Annual Analytical and Physical Testing Symposium, Cincinnati, Oct. 1964.

The application of the principle of thermal conductivity in the microdetermination of carbon in uranium and thorium metal is described. The method, which is rapid and simple, requires a minimum of operational training. Carbon can be determined with good precision and accuracy in the range of 50 to 5000 ppm under routine conditions, and the range has been extended to the 20 to 40 ppm level by minor modifications in operational technique. (auth)

2216 (NP-14343(p.IId1-5)) ANALYSES EN CONTINU DE LA TENEUR EN URANIUM ET ACIDITE LIBRE DES SOLUTIONS DE NITRATE D'URANYLE. (Continuous Analysis of Uranium Contents and Free Acidity in Uranyl Nitrate Solutions). T. Kikindai (Italy. Comitato Nazionale Energia Nucleare, Milan).

The heat of reaction was used to determine continuously

the uranium and nitric acid contents of process streams in order to adjust these two concentrations to the concentrations desired. The reactions used were $UO_2(NO_3)_2 + 4K_2CO_3 \rightarrow 2KNO_3 + K_2UO_2(CO_3)_2$ and $HNO_3 + K_2CO_3 \rightarrow KNO_3 + KHCO_3$. The experimental apparatus used to determine the feasibility of the use of this method for continuous analysis of process solutions is described. The performance was tested during several months of operation. Stability and reproducibility were good, and the time of response was almost zero for a device in operation. The performances seemed satisfactory for industrial utilization. (J.S.R.)

2217 (NP-14343(p.IIe1-12)) DOSAGE CONTINU DE L'URANIUM DANS UNE BATTERIE DE MELANGEHRS-DECANTEURS. (Continuous Dosage of Uranium in a Mixer-Settler Battery). F. Regnaud (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Fontenay-aux-Roses).

Utilization of the Technicon autoanalyzer for colorimetric determination of uranium in a mixer-settler battery was investigated. The principle of the autoanalyzer and its adaptation to uranium colorimetry is described. The tests made, after a brief laboratory trial, in the Chaine Gascogne at Fontenay-aux-Roses are reported. The results obtained up to the present are considered promising and future tests are described. (J.S.R.)

2218 (ORNL-P-635) METHODS USED AT ORNL FOR THE PRECISE DETERMINATION OF PLUTONIUM. Paul F. Thomason (Oak Ridge National Lab., Tenn.). [1961]. Contract W-7405-eng-26. 17p. (CONF-805-4). Dep.(mn); $1.00(cy), 1(mn) OTS.

For Presentation at European-American Nuclear Data Committee Meeting, Brussels, Jan. 1965.

A description is given of two methods used for the determination of plutonium: controlled-potential coulometric titration and automatic micro-potentiometric titration. Equipment used in these methods is also described. (D.L.C.)

2219 (ORNL-P-636) METHODS USED AT ORNL FOR THE PRECISE DETERMINATION OF URANIUM. Paul F. Thomason (Oak Ridge National Lab., Tenn.). [1964]. Contract W-7405-eng-26. 18p. (CONF-805-3). Dep.(mn); $1.00(cy), 1(mn) OTS.

For Presentation at European-American Nuclear Data Committee Meeting, Brussels, Jan. 1965.

Two electrochemical methods used for the routine determination of U are described: controlled-potential coulometric titration and automatic potentiometric titration. The equipment used in the methods and their operation are described in detail. (D.L.C.)

2220 (RT/CHI(64)-15) DETERMINAZIONE DI TRACCE DI ZOLFO NEI TERFENILI MEDIANTE RIDUZIONE CON NICKEL-RANEY. (Determination of Small Quantities of Sulfur in Terphenyls by Means of Raney Nickel Reduction). C. Bordonali, R. Caponetti, and B. Rossi (Italy. Comitato Nazionale per l'Energia Nucleare, Rome). July 1964. 12p. Dep.(mn).

A method for the quantitative determination of small quantities of sulphur (organic and inorganic) is described. This method is based on the reduction of sulphur to NiS by means of Ni–Raney and conversion to H_2S with HCl. H_2S is absorbed in an alkaline solution and titrated with $Hg(CH_3COO)_2$. This method is quantitative from about 100 to 1-2 ppm. One or two grams of substance are sufficient. Several tests at different sulphur content have shown that the standard deviation is 3.5 ppm at 55 ppm of sulphur present; 0.05 ppm at 1–1.5 ppm of sulphur present. (auth)

2221 (SRO-79) DETERMINATION OF THE UNIFORMITY OF MIXING OF PORTLAND CEMENT AND BITUMINOUS CONCRETE FOR VARIOUS MIXING TIMES BY THE USE OF RADIOISOTOPES. Final Technical Report for That Phase of the Program Dealing with Bituminous Concrete. Final Report, March 31, 1961–December 31, 1962. Paul K. Howard and Donald O. Covault (Georgia Inst. of Tech., Atlanta. Engineering Experiment Station). Jan. 20, 1963. Contract AT(38-1)-202. 76p. Dep.; $3.00(cy), 3(mn) OTS.

Uniformity of mixing is a good criterion by which to judge the quality of a bituminous concrete mix and mixing adequacy. In this research, mineral filler content of bituminous concrete mortar, fineness modulus of aggregate, and Hveem stability were used to indicate the uniformity of the mixed bituminous concrete. Fineness modulus and Hveem stability were determined by conventional methods. An attempt was made to determine mineral filler content of bituminous concrete mortar samples by neutron activation analysis of ^{49}Ca produced in the Ca in the mineral filler. Determination of mineral filler content was not possible using a Van de Graaff accelerator and Be target. It is believed that a neutron source producing a higher neutron flux, such as a reactor or some other neutron generator, would make the method possible. Mixing times of 30 sec or greater had no effect on the uniformity of mixing as measured by Hveem stability, fineness modulus or calcium count. However, differences from batch to batch were very significant for Hveem stability and less significant for fineness modulus and Ca count. Position and interactions have no effect on the uniformity of mixing. Neutron backscatter techniques did not prove feasible as a testing method for determining asphaltic cement content of in-place bituminous concrete pavements. However, neutron attenuation techniques did appear feasible for this determination using controlled testing environment. (auth)

2222 DETERMINATION OF COBALT IN 18/8 STEELS ON THE BASIS OF ^{60m}Co FORMATION BY THERMAL NEUTRON ACTIVATION. D. Monnier, W. Haerdi, and E. Roueche (Universite, Geneva). Anal. Chim. Acta, 31: 413-18(Nov. 1964).

A method for the determination of cobalt in 18/8 steels, based on formation of ^{60m}Co is proposed. Most of the iron is extracted, then cobalt is extracted as its α-nitroso-β-naphthol complex into toluene. The losses are determined exactly. A determination is complete within 2 hr with a precision of ±9%; the limit of sensitivity is 2 μg of cobalt. The results obtained (average 350 ppm) were compared with results obtained spectrophotometrically (average 368 ppm). (auth)

2223 THE DETERMINATION OF BROMINE IN ROCKS BY NEUTRON ACTIVATION ANALYSIS. R. H. Filby (Universitet, Oslo). Anal. Chim. Acta, 31: 434-40(Nov. 1964).

A neutron activation method for the determination of bromine in rocks and minerals is described. After removal of iodine, bromine is separated by oxidation with potassium permanganate and extraction with carbon tetrachloride. Bromine is then precipitated as silver bromide; yields are from 60 to 84%. The method has a sensitivity of 0.001 ppm of bromine and is free from interfering reactions. The values obtained for G-I and W-I, 0.484 and 0.496 ppm of bromine respectively, are lower than the average values for granites and basalts previously reported. (auth)

2224 RADIOCHEMICAL SEPARATION OF ZIRCONIUM FROM NIOBIUM WITH SALICYLHYDROXAMIC ACID. Syed Muhammad Qaim (Univ. of Liverpool). Anal. Chim. Acta, 31: 447-51(Nov. 1964).

Salicylhydroxamic acid was employed for the rapid radiochemical separation of zirconium from niobium. Neutron-deficient isotopes of the 2 elements formed in the spallation of niobium with 340-Mev protons were used as tracers. The method was employed in the study of short-lived zirconium and niobium activities using scintillation γ spectrometry. The procedure is complete in about 7 min, and gives a chemical yield of the order of 50–60% and a decontamination factor of at least 5×10^4. (auth)

2225 THE DIRECT POLAROGRAPHIC DETERMINATION OF URANIUM(VI) IN NITRIC ACID MEDIA. J. Mashall and J. Kendler (Atomic Energy Commission, Tel-Aviv, Israel). Anal. Chim. Acta, 31: 490-3(Nov. 1964).

A rapid method for the direct polarographic determination of uranium in synthetic nitric acid solutions is described. The supporting electrolyte is nitric acid saturated with a TBP-odorless kerosene mixture. Potential interferences and methods for their elimination are outlined. Metal ions such as copper and lead, which interfere, are not liable to be present in process solutions. (P.C.H.)

2226 THE SPECTROGRAPHIC DETERMINATION OF STRONTIUM AND BARIUM IN OXYGEN AND CARBON DIOXIDE ATMOSPHERES. F. Wilson and R. Chester (Univ. of Liverpool). Anal. Chim. Acta, 31: 493-7(Nov. 1964).

A fully enclosed arc chamber, which incorporated a modified Stallwood air-jet, was constructed for the spectrographic determination of Sr and Ba in O_2 and CO_2 atmospheres. The chamber is constructed of brass and Sindanyl and consists of 3 parts. The body of the chamber is provided with 3 windows, 2 of which allow an image of the electrodes to be projected on to a screen so that their position and separation can be controlled, and one, covered with a quartz disc, which allows the light from the arc to pass to the condensing mirror of the spectrograph. The top of the chamber has an opening to allow the hot gases to escape and is a truncated cone, which fits loosely around the upper electrode. It is probable that the use of O_2 or CO_2 could be incorporated with advantage into a general spectrographic scheme for the analysis of carbonate or silicate rocks, particularly for those elements whose sensitive lines cannot be used owing to masking by CN emission. (P.C.H.)

2227 X-RAY-FLUORESCENCE SPECTROMETRY IN THE HAFNIUM–ZIRCONIUM SYSTEM. J. Bermudez Polonio (Junta de Energia Nuclear, Madrid). Anales Real Soc. Espan. Fis. Quim. (Madrid), Ser. B, 60: 297-306(Apr. 1964). (In Spanish)

Procedures for determining hafnium in a zirconium matrix are outlined. When hafnium oxide concentration is higher than 0.1% the analysis involves the use of the Hf$L\alpha_1$ line and selective excitation, or the Hf$L\beta_1$ and both fine collimation and topaz analyzing crystal. Hafnium oxide amounts below 0.1 per cent require the use of a germanium analyzing crystal cut along the (111) planes to block the interfering second-order Zr$K\alpha$ radiation; the pulse-height analyzer is used to improve signal-to-background ratio and to discriminate the germanium fluorescent radiation emitted by the analyzing crystal. A systematic study to find the experimental pulse height analyzer working optimum is presented. The lower detection limit using the germanium analyzing crystal method is 150 ppm of hafnium oxide in a zirconium oxide matrix. (auth)

2228 THE DETERMINATION OF RADIOCERIUM IN BIOLOGICAL MATTER AND SEAWATER. B. L. Hampson (Ministry of Agriculture, Lowestoft, Suffolk, Eng.). Analyst, 89: 651-7(Oct. 1964).

A method for the routine measurement of cerium-141 and cerium-144 in biological materials and in seawater is described, in which the cerium is collected from bulky samples by co-precipitation with iron or titanium, and then purified by solvent extraction with the di-(2-ethylhexyl) hydrogen phosphate–n-heptane system. Quantitative recovery of the radiocerium is readily obtained. Sensitivity depends on sample size, and, for foodstuffs, measurements of both nuclides can be made at one thousandth of the respective maximum permissible concentrations appropriate to the general public with a precision of 6 per cent (3σ) with 150-g samples. The method also has application to low-level measurement of radiocerium. (auth)

2229 THE DETERMINATION OF CHROMIUM IN BIOLOGICAL MATERIAL BY RADIOACTIVATION. H. J. M. Bowen (Atomic Energy Research Establishment, Wantage, Berks, Eng.). Analyst, 89: 658-61(Oct. 1964).

A method was developed for determining chromium in biological material by using activation with thermal neutrons. Samples were activated in a flux of 10^{12} neutrons per cm^2 per second for 4 weeks, and the chromium-51 produced was separated chemically and counted. The practical limit of sensitivity was found to be 5×10^{-9} g, and decontamination from other long-lived nuclides was tested and found satisfactory. Chromium contents of plant tissue, human blood, and ox bone were measured by the procedure. (auth)

2230 GAS CHROMATOGRAPHIC SEPARATION OF THE HYDROGEN ISOTOPES. D. L. West and A. L. Marston (E. I. duPont de Nemours & Co., Aiken, S. C.). J. Am. Chem. Soc., 86: 4731(Nov. 5, 1964).

The gas chromatographic separation of the hydrogen isotopes at high tritium concentrations was studied. In no case was there indication that the tritium radiation level had significantly affected the separation factor. Data are tabulated. (P.C.H.)

2231 MODERN TECHNIQUES FOR SEPARATING THE RARE-EARTH ELEMENTS. N. E. Topp (National Chemical Lab., Teddington, Middx, Eng.). J. Less-Common Metals, 7: 411-19(Dec. 1964).

Fractional crystallization techniques for purifying the rare-earth elements have been rendered obsolete by the development of chromatographic and counter-current solvent extraction techniques. Two of the older methods retain their importance. These are the sulfate group separation methods, and valency change methods for the isolation of cerium and europium. Four of the newer techniques are discussed. These are ion-exchange chromatography; solvent extraction; amalgam extraction; and ion-exchange membranes. (auth)

2232 MASS SPECTROGRAPHIC ANALYSIS OF ERBIUM, CERIUM AND LUTETIUM METAL. J. W. Guthrie (Sandia Lab., Albuquerque, N. Mex.). J. Less-Common Metals, 7: 420-6(Dec. 1964).

A mass spectrograph equipped with an r-f spark ion source and a photographic plate ion detection system is being used to obtain semiquantitative analyses of homogeneous bulk impurities in commercially available rare-earth metals. Analyses of 50 elements in 6 different erbium samples, 41 elements in 2 different cerium samples, and 26 elements in 5 different lutetium samples were made using a detection limit range of 0.1–20 ppm atomic. Results for hydrogen, carbon, nitrogen, and oxygen by microcombustion and neutron activation techniques are in poor agreement with the mass spectrographic results. Nonhomogeneity can be a serious problem and an important factor when purity is stated for a given rare-earth metal. (auth)

2233 GRAVIMETRIC DETERMINATION OF NIOBIUM AND ITS SEPARATION FROM TANTALUM AND MOLYBDENUM USING 4-PHENYLDAPHNETIN. B. D. Jain and H. B. Singh (Univ. of Delhi). J. Less-Common Metals, 7: 464-6(Dec. 1964).

The use of 4-phenyldaphnetin for the gravimetric estimation of Nb and its separation from Ta and Mo is described. The precipitation of niobium-4-phenyldaphnetin complex was found to be quantitative between pH 5.0-8.5 and to be negligible below pH 2.0. Fluoride ions, even when present in concentrations about seven times that of the Nb, do not cause any interference in the estimation of Nb using 4-phenyldaphnetin. Ta is precipitated quantitatively at pH 5.0–8.5 but the resulting precipitate is insoluble in alcohol, in contrast to the niobium-4-phenyldaphnetin complex formed under these conditions which is alcohol-soluble. This difference in solubility of the precipitates was used for the separation of Nb and Ta. Mo(VI) forms an orange-red water-soluble complex with alcoholic solution of 4-phenyldaphnetin. Since Nb complex with the reagent is insoluble in water, equal amounts of Nb were separated from Mo. (P.C.H.)

2234 ISOLATION AND ANALYSIS OF THE RARE EARTH ELEMENTS BY PAPER CHROMATOGRAPHY. III. THE USE OF TNOA-AMMONIUM NITRATE. Shu-wei Pang and Shu-chuan Liang. K'o Hsueh T'ung Pao, No. 2, 156(1964).

The R_f values for La, Sm, Eu, Gd, Y, and UO_2 in 0.2M solution of tri-(n-octyl)amine (TNOA) in benzene with varying concentrations of ammonium nitrate and/or nitric acid

(0.01–1.0N) are reported. Y, Sm, Eu, and Gd traveled the furthest in all cases and could not be separated from each other, but were readily separated from La and uranium, the latter remaining near the origin. (OTS)

2235 USE OF ALPHA-METHOXYPHENYLACETIC ACID AS A PRECIPITATING AGENT FOR ZIRCONIUM. Shu-chuan Liang and Shun-jung Wang. K'o Hsueh T'ung Pao, No. 2, 157(1964).

Attempts were made to use a new reagent, α-methoxyphenylacetic acid, obtained by replacing the hydroxyl group in mandelic acid with a methoxy radical, for the precipitation of zirconium. Addition of this reagent to zirconium solutions produced a white powdery precipitate at pH 0.8–1.4, indicating that it is also suitable for the gravimetric determination of zirconium. (TCO)

2236 SPECTROPHOTOMETRIC DETERMINATION OF THE RARE EARTHS USING p-(2-AZO-PYRIDINE)-RESORCINOL (PAR). Shun-jung Wang, Shin-fen Mou, and Shu-chuan Liang. K'o Hsueh T'ung Pao, No. 3, 249(1964).

The results of a colorimetric study of the complexes between PAR and the rare earth elements at pH values ranging from 6.5 to 10.2 and varying proportions of metal and indicator are reported. At a pH of 8.1 and a PAR concentration of 2.3×10^{-3}M, complexes with a reddish orange to red color were obtained. The extinction coefficient for La, Nd, Sm, Gd, Y, Dy, and Er was 27, 100, 60, 300, 75,300, 59,300, 58,000, 59,400, and 59,400, respectively. (OTS)

2237 ANALYSIS OF GRADED PURITY NICKEL. Maria Csajka and Maria Oerdoegh. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen, 12: 335-44(1964). (In Hungarian)

The activation analysis method for the quantitative determination of arsenic, antimony, zinc, and bismuth contamination in graded-purity nickel is described. The contaminants are separated from one another and from the activated matrix element on Dowex 1 × 8 anion exchange column in the chloride form. The elements to be determined are precipitated from the individual fractions and each of the collected precipitates is measured by gamma spectrometry. (auth)

2238 NEUTRON ACTIVATION ANALYSIS OF REACTOR-GRADE URANIUM COMPOUNDS. Maria Oerdoegh, Dezsö Hegedues, and Elek Szabó. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen, 12: 345-53(1964). (In Hungarian)

A novel method was developed for determining contaminants in reactor-grade uranium compounds. It consists of removing by paper chromatography the bulk of the uranium component prior to irradiation. After irradiation the contaminants are isolated and measured by three different methods, namely: chemical separation with carrier; fast gamma spectrometry; and paper chromatography. (auth)

2239 DETERMINATION OF TRACE ELEMENTS IN ROCKS BY NEUTRON ACTIVATION ANALYSIS. Elek Szabó, Elek Antal, Maria Oerdoegh, and Endre Upor. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen, 12: 355-64(1964). (In Hungarian)

A method for the determination of trace amounts of tantalum, silver, and hafnium in sandy rocks is described. The irradiated sample is first leached, then tantalum is extracted, while silver and hafnium are precipitated in the form of AgCl and zirconium/hafnium/tetramandelate, respectively. The isolated products are further purified and the activities measured by gamma spectrometry. (auth)

2240 NEUTRON ACTIVATION ANALYSIS OF GRADED PURITY SILICON. Veronika Upor-Javancz and Maria Oerdoegh. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen, 12: 365-76(1964). (In Hungarian)

Trace contaminants of semiconductor silicon were determined by nondestructive gamma spectrometry. Coincidence between the photopeaks of isotopes with different half lives can be minimized by alteration of the irradiation and cooling periods. The complex spectra are evaluated by the complement subtraction method. The analysis can be refined by paper chromatographing the contaminants and evaluating the spectra of the active spots. The technique lends itself for the simultaneous determination of 14 elements. (auth)

2241 NON-DESTRUCTIVE ANALYSIS OF DIPHENYL AND DIPHENYL METHANE BY NEUTRON ACTIVATION. Elisabeth Kelen and Maria Oerdoegh. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen, 12: 377-84(1964). (In Hungarian)

A method was developed for the neutron activation analysis of trace contaminants in diphenyl and diphenylmethane-type organics. These materials lend themselves well for this nondestructive technique, since the main constituents are either not activated by irradiation or short-lived isotopes are produced which do not interfere with the measurement. The samples and adequately prepared standards are irradiated in the reactor and their gamma spectra taken subsequently on a 128-channel pulse height analyzer. The spectra are evaluated by the complement subtraction method or by calculating the peak areas. Tabulated results are given. The method is suitable for the fast, sensitive, and fairly accurate analysis of trace impurities in organic materials. (auth)

2242 PHOTOMETRIC DETERMINATION OF SMALL AMOUNT OF THORIUM IN BIOMATERIALS. P. A. Pavlovskaya and T. N. Cherkashina. Materialy po Toksikol. Radioaktivn. Veshchestv, Akad. Med. Nauk SSSR, No. 4, 73-6(1964). (In Russian)

Small quantities of thorium were determined in biological materials by reaction with azenazo III. The minimum amount determined was 2 γ. The error did not exceed 15%. Impurities of PO_4^{3+} in ratios to Th of 1500:1 do not interfere. (R.V.J.)

2243 ANALYTICAL APPLICATIONS OF ANION EXCHANGE OF URANIUM AND THORIUM IN MIXED AQUEOUS AND NON-AQUEOUS SYSTEMS. [PART] I. J. Korkisch (Universität, Vienna). Mikrochim. Ichnoanal. Acta No. 5, 816-72(1964). (In German)

The anion exchange behavior of uranium, thorium, and some other elements in solvent mixtures is described. The adsorption conduct of these elements toward the strongly basic anion exchanger Dowex 1 was investigated in mixtures that contained hydrochloric, nitric, and sulfuric acid as complex formers. Aliphatic alcohols, ketones, ethers, and carboxylic acids were employed as the organic components of the solvent mixtures. Determination of the distribution coefficients of the two elements in mixtures of different solvent concentration provided the basis for working out analytically usable isolation and separation methods for uranium, thorium, and other elements. It was found that several of these methods furnished means of isolating uranium, thorium, the rare earths, and still other elements from natural materials and for separating them from foreign ions, so that the final analytical determination of uranium etc. could then be carried out without interference. By means of other procedures, it is possible to accomplish separations of the most diverse elements from each other and also to achieve group separations through application of the principle of solvent exchange separation. 146 references are cited. (auth)

2244 DETERMINATION OF RADIOSTRONTIUM ^{90}Sr AS ^{90}Y(III) OXIDE. Jerzy Godek (Krakow Technical Univ.). Naturwissenschaften, 51: 462(1964). (In German)

The separation of ^{90}Sr and its determination as $^{90}Y(OH)_3$ from aqueous solutions in the presence and absence of the radionuclides of the natural series are described. It was determined that the quantitative precipitation of $Y(OH)_3$ occurs at pH 8. The volume of precipitating solution and concentration of Ca^{2+} do not affect the yield. The ^{90}Y yield is quantitative in all chemical operations in the yttrium method in the presence of alkaline earth metals (without Ra), but the presence of the radionuclides of the natural series greatly interferes with the determination of ^{90}Y. (J.S.R.)

2245 MASS SPECTROSCOPY OF THE SMALLEST QUANTITIES OF MATERIALS IN NUCLEAR PHYSICS AND

IN ISOTOPE COSMOLOGY. H. Hintenberger. Naturwissenschaften, 51: 473-80(1964). (In German)

The mass spectroscopic detection of a substance takes place in three steps: production of an ion beam in a vacuum, splitting of the ion beam according to particles of different masses, and ion detection. For each of the three steps, the methods are discussed. Mass determinations, isotope frequency measurements, and determination of small amounts of substances are discussed. Uses in nuclear physics for identification of stable and products of nuclear reactions and measuring mass spectra of radioactive materials are described. (M.C.G.)

2246 LIQUID-LIQUID EXTRACTION OF URANIUM(VI) WITH MESITYL OXIDE AS AN EXTRACTING AGENT. S. M. Khopkar (Indian Inst. of Tech., Bombay). Sci. Cult. (Calcutta), 30: 191(Apr. 1964).

A method for the liquid-liquid extraction of U(VI) using mesityl oxide, $(CH_3)_2$-C-CH = CO-CH_3, is described. The method provides clean-cut separation of U(VI) in a minimum time. Generally 6N HNO_3 with about 15% of the salting-out agent (sodium nitrate) with undiluted mesityl oxide was sufficient for quantitative extraction of U(VI). (P.C.H.)

2247 NOBLE GASES IN SEA WATER. Rudolph Bieri, Minoru Koide, and Edward D. Goldberg (Univ. of California, San Diego, La Jolla). Science, 146: 1035-7(Nov. 20, 1964).

Concentrations of noble gases in samples of sea water obtained at depths to 3437 meters from a Pacific Ocean station were measured by mass spectrometry. An excess of helium, in relation to concentrations of the other noble gases, was attributed to influx of atoms of this gas from the sediments where it is produced by the natural radioactive decay of members of the uranium and thorium series. On the basis of a steady-state model, the escape of helium from the earth is calculated at 6.4×10^{13} atoms per square centimeter per year. (auth)

2248 REACTOR PULSING IN ACTIVATION ANALYSIS. Herbert P. Yule (General Atomic Div., General Dynamics Corp., San Diego Calif.). Trans. Am. Nucl. Soc., 7: 326-7(Nov. 1964).

2249 THE DETERMINATION OF TRACE LEVELS OF SELENIUM IN BIOLOGICAL SAMPLES BY NEUTRON ACTIVATION ANALYSIS INCLUDING MINIMIZATION OF INTERFERENCES WITH 17.5-SECOND SELENIUM-77m. Diane M. Fleishman and V. P. Guinn (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 327-8(Nov. 1964).

2250 DETERMINATION OF PHOSPHORUS BY FAST-NEUTRON ACTIVATION ANALYSIS. To-on Maen, Fred Sicilio, and Richard E. Wainerdi (Agricultural and Mechanical Univ., College Station, Tex.). Trans. Am. Nucl. Soc., 7: 328(Nov. 1964).

2251 DETERMINATION OF CHLORINE BY INSTRUMENTAL NEUTRON ACTIVATION. R. A. Johnson and B. E. Gordon (Shell Development Co., Emeryville, Calif.). Trans. Am. Nucl. Soc., 7: 328-9(Nov. 1964).

2252 A METHOD OF COMPARING GAMMA-RAY SPECTRA FOR THE PRESENTATION OF ACTIVATION ANALYSIS RESULTS IN COURT. D. E. Bryan and V. P. Guinn (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 329(Nov. 1964).

2253 DETERMINATION OF CERIUM AND PRASEODYMIUM IN ORES AND MINERALS USING 14.5 Mev NEUTRON ACTIVATION ANALYSIS. M. Cuypers and M. P. Menon (Agricultural and Mechanical Univ., College Station, Tex.). Trans. Am. Nucl. Soc., 7: 330-1(Nov. 1964).

2254 RADIOCHEMICAL SEPARATION OF MERCURY IN NEUTRON ACTIVATION ANALYSIS. C. K. Kim and J. Silverman (Univ. of Maryland, College Park). Trans. Am. Nucl. Soc., 7: 332(Nov. 1964).

2255 THE DETERMINATION OF ZIRCONIUM BY NEUTRON ACTIVATION ANALYSIS: USE OF CHEMICALLY SEPARATED NIOBIUM-97. T. K. Choy, H. R. Lukens, and G. H. Andersen (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 332-3 (Nov. 1964).

2256 RADIOMETRIC SENSING OF ATOMIC HYDROGEN IN TRACE QUANTITIES. Richard L. Bersin (Tracerlab, Inc., Richmond, Calif.). Trans. Am. Nucl. Soc., 7: 336-7(Nov. 1964).

2257 A DETERMINATION OF TRACE AMOUNTS OF IRON AND COBALT IN THE SAME SAMPLE BY SUBSTOICHIOMETRIC RADIOISOTOPIC DILUTION ANALYSIS. A. R. Landgrebe, L. McClendon, and J. R. DeVoe (National Bureau of Standards, Washington, D. C.). Trans. Am. Nucl. Soc., 7: 337-8(Nov. 1964).

2258 USE OF NEUTRON-CAPTURE GAMMA RAYS FOR NONDESTRUCTIVE ANALYSIS OF BURNABLE POISONS IN FULLY ENRICHED URANIUM FUEL. R. C. Greenwood and Jan Spalek (Illinois Inst. of Tech., Chicago). Trans. Am. Nucl. Soc., 7: 343-4(Nov. 1964).

2259 DETERMINATION OF NEODYMIUM-148 IN IRRADIATED UO_2 AS A MEASUREMENT OF BURNUP. B. F. Rider, J. P. Peterson, Jr., and C. P. Ruiz (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 7: 350-1(Nov. 1964).

2260 1-(o-ARSENOPHENYLAZO)-2-NAPHTHOL-3,6-DISULPHONATE (THORON) AS AN INDICATOR FOR THE COMPLEXOMETRIC DETERMINATION OF THORIUM. Satendra P. Sangal (Univ. of Allahabad, India). Vijnana Parishad Anusandhan Patrika, 6: 49-53(Jan.-Apr. 1963). (In Hindi)

1-(o-Arsenophenylazo)-2-naphthol-3,6-disulfonate (Thoron) was used as a chelatochrome indicator in the complexometric determination of thorium(IV) against EDTA. Two drops of 0.5% solution of indicator give a sharp end point. Titrations were possible up to dilution of 0.005 M solutions at a pH range of 2.5 to 3.0 and at all temperatures between 0 and 100°C. Interference due to a large number of foreign ions was observed, but sodium, potassium, lithium, silver, magnesium, calcium, barium, zinc, cadmium, mercury, lead, manganese, and ammonium did not interfere. (auth)

2261 RADIOACTIVE ISOTOPE DILUTION ANALYSIS. R.C.C. Review 2. (Gt. Brit. Radiochemical Centre, Amersham, Bucks, England). Apr. 1964. 12p.

A review is presented on radioisotope dilution analysis including: the principle of the analysis; laboratory and material requirements; developments in dilution analysis, including derivative dilution, and saturation analysis; and inorganic applications. (P.C.H.)

2262 TECHNIQUES FOR THE USE OF RADIOISOTOPES IN ANALYSIS. D. A. Lambie. A Laboratory Manual. Princeton, N. J., D. Van Nostrand Co., Inc., 1964. 140p. $4.85.

Information is included on: the application of radioisotopes in analysis; the laboratory and its organization; analytical operations; measurement of radioactivity; and calculation, assessment of results, and choice of method. Rules and regulations governing the use of radioisotopes in the U. S. are appended. (P.C.H.)

2263 THE APPLICATIONS OF NUCLEAR ACTIVATION ANALYSIS. Wayne Cassatt (Washington State Univ., Pullman). p.7-19 of "Nuclear Applications to the Wood, Paper, and Pulp Industries Conference." Pullman, Wash., Washington State Univ., 1964.

The principles of activation analysis are discussed: decay, beta and gamma-ray spectrometry, coincidence measurements, and conversion of count rate into amounts of an element. A brief description is given of the techniques used. Finally, some applications of activation analysis and some recent developments are discussed. (D.L.C.)

2264 NEUTRON ACTIVATION ANALYSIS FOR PROCESS CONTROL. Vincent P. Guinn (General Atomic Div. General Dynamics Corp., San Diego, Calif.). p.105-17 of "Nuclear Applications to the Wood, Paper, and Pulp Industries Conference." Pullman, Wash., Washington State Univ., 1964.

Process control based on in situ neutron activation analysis is still in the embryonic state. A description is given of the types of process control that are especially susceptible to economic solution using activation analysis. It is shown that such systems can be constructed and operated at amortizable costs. (D.L.C.)

2265 A PARTIAL BIBLIOGRAPHY OF LITERATURE ON NEUTRON ACTIVATION ANALYSIS. p.141-5 of "Nuclear Applications to the Wood, Paper, and Pulp Industries Conference." Pullman, Wash., Washington State Univ., 1964.

A total of 62 references is presented, arranged under the following headings: books, review and survey articles, applications, techniques and sensitivities, bibliographies, and related reference works. (D.L.C.)

Inorganic and Physical Chemistry

Refer also to abstract 2828.

2266 (AFOSR-64-0039) MOLTEN SALT DATA. Electrical Conductance, Density, and Viscosity. George J. Janz, Anthony T. Ward, and Roger D. Reeves (Rensselaer Polytechnic Inst., Troy, N. Y.). July 1964. 191p. (AD-605938) $6.00(OTS)

Conductance, density, and viscosity data at round values of temperature (°K) are given for some 126 inorganic compounds as Single-Salt Melts (fluorides, 15; chlorides, 34; bromides, 20; iodides, 23; oxides, 7; sulfates, 5; nitrates, 7; carbonates, 3; and miscellaneous, 12). Equations expressing the temperature dependence of these properties for the single-salt melts are also given. For mixtures of these salts, the binary systems that have received attention are listed; numerical values for these mixtures are not given but are referenced. (auth)

2267 (ANL-6907) THE EFFECT OF PARTICLE SIZE ON THE PROPERTIES OF GAS-FLUIDIZED BEDS. K. S. Sutherland (Argonne National Lab., Ill.). July 1964. Contract W-31-109-eng-38. 52p. Dep.; $3.00(cy), 1(mn) OTS.

The development of a continuous method for determining changes in particle size and particle size distribution in fluid-bed systems was studied experimentally. Differential pressure measurements were employed to study the effects of solid particle size on the behavior of gas-fluidized beds. The relevant bed properties are briefly described and a review given of previous work on the study of fluidized-bed quality. It is shown that, within certain limitations, measurements of bed quality can be used to indicate changes in particle size. Gas-bubble velocities, while increasing in proportion to the square root of bubble diameter, are also shown to be dependent on particle size, increasing as the particle size decreases. (auth)

2268 (ANL-6916) INDEX AND DISPERSION OF SOME ČERENKOV COUNTER GASES. E. R. Hayes, R. A. Schluter and A. Tamosaitis (Argonne National Lab., Ill.). Aug. 1964. Contract W-31-109-eng-38. 36p. Dep.; $2.00(OTS).

The index of refraction, n, and dispersion of several Cherenkov counter gases was precisely measured by the interferometric method. The precision is typically four parts in $(n-1) \times 10^5$. The gases investigated include Freon 12(CCl_2F_2); Freon 13($CClF_3$); Freon 13B1($CBrF_3$); Freon 22($CHClF_2$); Freon 116(CF_3-CF_3); Freon 218(Perfluoropropane); Perfluorobutane (C_4H_{10}), as well as nitrogen, carbon dioxide, and dry air. Measurements of n were made at 5460, 4360, 4050, 3650, and 3125Å. For Freon 13 and carbon dioxide, the measurements were carried to pressures near the critical point. (auth)

2269 (BNL-8514) NEUTRON DIFFRACTION DATA AND COVALENCY EFFECTS. R. Nathans, G. Will, and D. E. Cox (Brookhaven National Lab., Upton, N. Y.). [1964]. Contract AT-30-2-GEN-16. 6p. (CONF-788-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From International Conference on Magnetism, Nottingham, Eng., Sept. 1964.

The possibility of detecting the effects of covalent bonding in magnetic salts by neutron diffraction is discussed, and some experimental results for MnO, $LaCrO_3$, $LaFeO_3$, and $LaMnO_3$ are presented. (R.E.U.)

2270 (COO-623-103) LOW-TEMPERATURE THERMAL EXPANSION COEFFICIENT OF LiF (thesis). Technical Report No. 35. Richard Miles (Case Inst. of Tech., Cleveland). June 1964. Contract AT(11-1)-623. 30p. Dep.(mn); $2.00(cy), 1(mn) OTS.

The linear thermal expansion coefficient, α, of LiF was measured by an x-ray technique from 60 to 290°K. The Gruneisen parameter $\gamma \equiv 3\alpha V B_s / C_p$ was calculated and analyzed in terms of the quasi-harmonic approximation. A low temperature value for γ was obtained from the pressure variation of the elastic constants by means of a numerical integration machine calculation, and it agrees favorably with the recent 14°K value of γ as calculated from White's extremely low temperature thermal expansion data. (auth)

2271 (EUR-1908.e) OSCILLOGRAPHIC POLAROGRAPHY IN MOLTEN NITRATES. I. THE VALIDITY OF THE RANDLES-SEVCIK EQUATION. M. Francini and Silvana Martini (European Atomic Energy Community. Joint Nuclear Research Center, Ispra, Italy). 1964. 57p. (CONF-151-6) Dep.(mn).

From 19th International Union of Pure and Applied Chemistry Congress, London, July 1963.

The polarographic investigation of Pb, Cd, Tl, Ni, and Zn nitrates in a $KNO_3-LiNO_3-NaNO_3$ molten eutectic mixture was carried out by conventional and oscillographic (single-sweep) polarography. Experiments were carried out in the temperature range 140 to 200°C, with the dropping mercury electrode as the cathode and a large Pt foil or an Ag/AgCl reference electrode acting as anodes. For reversible electrode reactions (Cd, Pb, and Tl) the polarographic diffusion coefficients calculated from conventional polarography data by the Ilkovic equation agree within experimental errors with those obtained from oscillographic data by the Randles-Sevcik equation at low potential change rates. At higher potential change rates, deviation of the experimental value of the peak currents from the theoretical ones were observed. This is associated with a marked distortion of the wave and indicates a certain degree of irreversibility of the electrode reaction. The temperature dependence of the diffusion coefficients in the investigated range is the same for ions showing reversible behavior (Cd, Pb, and Tl), and the corresponding activation energy of the diffusion process is E = −8,400 cal/mole. (auth)

2272 (HW-SA-3199) THE ADSORPTION OF CESIUM AND STRONTIUM ON ZEOLITES FROM MULTICOMPONENT SYSTEMS. B. W. Mercer, Jr., and L. L. Ames, Jr. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 1, 1963. Contract AT(45-1)-1350. 28p. Dep.(mn); $2.00(cy), 1(mn) OTS.

Mass action quotients for Cs^+ and Sr^{+2} with the synthetic zeolites Linde 4A, 13X, AW-400, AW-500, Norton Zeolon, and the natural zeolite clinoptilolite, were determined in binary systems. A method of using binary exchange data to predict the amount of cations adsorbed by the zeolites from multicomponent systems was developed. Predicted values for Cs^+ and Sr^{+2} adsorption generally agreed with experimental values except for 4A and AW-400 with a quaternary mixture of Na^+, Cs^+, Sr^{+2}, and Ca^{+2}, where Cs^+ adsorption was greater and Sr^{+2} adsorption less than predicted. Experimental values of 1.5 meq of Cs^+ or 2.5 meq of Sr^{+2} adsorbed per gram of zeolite were determined for columns receiving feed solutions containing either Cs^+ or Sr^{+2}. The uptake of both Cs^+ and Sr^{+2} by 4A zeolite from a mixed feed was 0.9 meq of Cs^+ and 1.3 meq of Sr^{+2}

per gram of zeolite. Liquid diffusion coefficients for Sr^{+2} in a ternary cation mixture were calculated from electrical conductivity data and found to vary from 7.4×10^{-6} cm²/sec at 25C to 1.8×10^{-5} cm²/sec at 80°C. Particle diffusion coefficients for Sr^{+2} in 4A zeolite were calculated from column breakthrough data and the average value found to vary from 1.6×10^{-7} cm²/sec at 25C to 5.2×10^{-7} cm²/sec at 80°C. (auth)

2273 (IA-941) ACTIVITIES IN THE MOLTEN SILVER–SODIUM NITRATE SYSTEM. M. Liquornik and Y. Marcus (Israel. Atomic Energy Commission. Soreq Research Establishment, Rehovoth). June 1964. 13p. (CONF-742-2). Dep.(mn).

From 15th CITCE Meeting (International Committee on Thermodynamics and Electrochemical Kinetics) London, Sept. 1964.

The suggestion of Laity that mixtures of molten sodium and silver nitrates behave like regular solutions has been criticized. New potentiometric measurements were made over the complete mole fraction range and over a temperature range from the melting point to 4000°C, and it is concluded that the excess entropy of mixing is not zero. Partial thermodynamic quantities were calculated from the data, and the enthalpy obtained compared with the reported calorimetric value. (auth)

2274 (PAN-536/II) NOTE ON THE CRYSTAL STRUCTURE OF $MgCr_2O_4$. M. K. Fayek and A. Murasik (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). July 1964. 7p. Dep.

Neutron diffraction patterns have been obtained for polycrystalline $MgCr_2O_4$ at room temperature. In agreement with previous x-ray investigations, $MgCr_2O_4$ has been found to possess a regular spinel structure with a normal distribution of cations. The determination of the oxygen parameter gave a value of 0.2603. (auth)

2275 (SC-DC-64-1559) COMBUSTION OF ZIRCONIUM DROPLETS IGNITED BY FLASH HEATING. L. S. Nelson (Sandia Lab., Albuquerque, N. Mex.). Aug. 30, 1964. Contract AT(29-1)-789. 25p. (CONF-815-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 1964 Fall Meeting, Western States Section, The Combustion Institute, Salt Lake City, Oct. 1964.

The flash heating technique was used to study the combustion and explosion of zirconium droplets in air and oxygen–argon mixtures. Several new features involved in the combustion of zirconium have been described. These include showing that nitrogen is an active participant in the process when burning occurs in air, and that the explosions occur as a result of cooling and partial solidification of the droplets rather than of a steadily increasing temperature. A mechanism is proposed to explain the explosions based on the release of a permanent gas into the still-molten interior as the exterior of the droplet begins to solidify. (D.L.C.)

2276 (UCRL-11575) VAPOR PRESSURE DETERMINATION OF MANGANESE ACTIVITIES IN IRON–MANGANESE ALLOYS (thesis). Prodyot Roy (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley). Aug. 1964. Contract W-7405-eng-48. 90p. Dep.(mn); $3.00(cy), 2(mn) OTS.

The activities of manganese and its temperature coefficients between 1240 and 1510°K in the iron–manganese system have been measured by Knudsen and torsion effusion techniques. The heats of formation calculated from the present data at 1450° agree fairly well with the values obtained previously by acid solution calorimetry and heat content measurements by Kendall and Hultgren. The relative partial excess Gibbs energies for the manganese component obtained by this investigation are 100 to 700 cal/gram atom more positive than the values obtained by Butler, McCabe, and Paxton, and Lyubimov et al. This discrepancy is attributed to the depletion of surface concentration of manganese in the alloy in the previous investigations. The present data agree very well with Smith, Paxton, and McCabe. A severe surface depletion of manganese was observed during the course of the experiment for alloys containing less than 40 atomic percent manganese. The increase of rate of diffusion of manganese by 125 percent when the manganese concentration in the alloy was increased from 4 to 60 atomic percent as observed by Well and Mehl tends to confirm the present observation that the surface depletion becomes more significant for lower manganese concentrations. A few possible solutions to overcome the depletion of the vaporizing component at the surface of the alloy have been suggested. An attempt has been made to explain the observed rather large negative excess entropies of formation in terms of the properties of the pure components. (auth)

2277 (ANL-Trans-116) EQUILIBRIUM IN THE SYSTEM $NH_4F–BeF_2–H_2O$ AT 0°. A. V. Novoselova and M. Ya. Averkova. Translated by Elmar K. Wilip (Argonne National Lab., Ill.), from Zh. Obshch. Khim., 9: 1063-6 (1939). 6p. Dep.(mn); $1.00(cy), 1(mn) OTS; $1.10(fs), $0.80(mf) JCL.

The solubility curve of the ternary system $NH_4F–BeF_2–H_2O$ was determined at 0°C. The results show that, besides the binary salt $2NH_4F \cdot BeF_2$, a salt of composition $NH_4F \cdot BeF_2$ also exists. The salt $NH_4F \cdot BeF_2$ was also synthesized from $Be(OH)_2$, HF, and $(NH_4)_2CO_3$. (D.L.C.)

2278 (ANL-Trans-117) $MgCl_2–LiCl$ SYSTEM. E. A. Ukshe and N. G. Bukun. Translated by Elmar K. Wilip (Argonne National Lab., Ill.), from Zh. Neorgan. Khim., 9: 1766-7(1964). 4p. Dep.(mn); $1.00(cy) 1(mn) OTS; $1.10(fs), $0.80(mf) JCL.

The minimum capacity method (measurement of the capacity in the vicinity of the zero charge point of the lead electrode) was used to study the molten system $MgCl_2–LiCl$ at 720°C. The asymmetry of the capacity curves for some of the mixtures is noted. The dependence of the minimum capacity on the salt composition shows a maximum at ~3% $MgCl_2$. The results are discussed in terms of the structure of LiCl, $MgCl_2$, and LiCl containing small amounts of $MgCl_2$. (D.L.C.)

2279 (CEA-tr-R-1764) PROBLEME SUR LES CONDITIONS DE TRANSPORT ET DE DEPOT DE L'URANIUM PAR LES SOLUTIONS HYDROTHERMALES ET SUR LE ROLE DE FORMATION DE COMPLEXES PENDANT CES PROCESSUS. (Research on the Conditions for Transport and Deposition of Uranium in Hydrothermal Solutions and on the Role of Complex Formation in the Process). R. P. Rafalskii (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Translated into French from Geokhimiya, 5: 512-14(1963). 10p. Dep.(mn); $1.10(fs), $0.80(mf) JCL.

Conclusions drawn from previous studies on the transport and deposition of uranium in hydrothermal solutions are refuted. It was felt that experimental data obtained from a given set of experimental conditions could not be used to form an hypothesis on the transport and deposition of uranium under different conditions. (J.S.R.)

2280 (IS-Trans-7) PHASE DIAGRAMS OF THE SYSTEM THORIUM CHLORIDE–ALKALI CHLORIDES AND THORIUM CHLORIDE–EUTECTIC CHLORIDES. Seiichi Tanii. Translated by Totaro Goto (Ames Lab., Ames, Iowa), from Denki Kagaku, 32: 167-70(1964). 9p. Dep.(mn); $1.10(fs), $0.80(mf). JCL.

Phase diagrams were determined by differential thermal analysis for mixtures of $ThCl_4$ with: LiCl, NaCl, KCl, LiCl–KCl eutectic, KCl–NaCl eutectic, LiCl–KCl–NaCl eutectic, $CaCl_2$–NaCl eutectic, and $MgCl_2$–KCl eutectic. The results for the binary mixtures show the existence of Li_4ThCl_8, Na_2ThCl_6, and K_2ThCl_6, and the eutectic points were determined. The results for the eutectic salt mixtures show that it is possible to reduce the temperature of the $ThCl_4$ electrolysis bath to 500 or 600°C. (D.L.C.)

2281 ARGONNE'S CONTRIBUTION TO XENON CHEMISTRY. Argonne Natl. Lab. Rev., 1: No. 4, 17-19 (Oct. 1964).

A review is presented on the discovery and development of xenon compounds. Safety procedures are suggested for working with xenon and its compounds, particularly xenon fluorides and oxides. (P.C.H.)

2282 NEW ABSORPTION SPECTRUM FOR XENON IN THE EXTREME ULTRAVIOLET. Nicole Damany-Astoin (Centre National de la Recherche Scientifique, Bellevue, France). Compt. Rend., 259: 1492-6(Aug. 24, 1964). (In French)

An absorption spectrum was obtained for xenon between 160 and 190 Å, attributed to electron transitions from an internal level to successive excited levels of the external shell [$N_{IV,V}(4\underline{d}) \rightarrow (np)$]. These constitute two series analogous to the Rydberg series, followed by continuous absorption corresponding to ionization. The respective values of the energies of the N_{IV} and N_V levels were deduced. (tr-auth)

2283 THERMODYNAMIC STUDY OF MOLTEN MIXTURES OF POTASSIUM NITRATE AND LITHIUM NITRATE. Yves Doucet and Catherine Vallet (Faculte des Sciences, Marseille, France). Compt. Rend., 259: 1517-19(Aug. 24, 1964). (In French)

The binary system KNO_3– $LiNO_3$ has a eutectic and a transition point. Calculation of the activity coefficient, from the liquidus, made possible the calculation of the excess free enthalpy of each solution at its equilibrium temperature and of excess chemical potentials of each constituent. It was found that the solutions of $LiNO_3$ in KNO_3 are "strictly regular." (tr-auth)

2284 A RELATIONSHIP BETWEEN THE FIGURE OF MERIT OF TRANSITION METAL MONOCARBIDES AND MONONITRIDES VERSUS THEIR ATOMIC CHARACTERISTICS. V. S. Neshpor and G. V. Samsonov (Inst. of Problems of Material Behavior, Academy of Sciences, Ukrainian SSR). Dokl. Akad. Nauk SSSR, 157: 834-6(Aug. 1, 1964). (In Russian)

The figure of merit Z, calculated from the formula $Z = \alpha^2/\rho\lambda$ (here α is the thermal emf of the material, ρ is the specific electric resistance, and λ is the thermal conductivity), is given in parenthesis for the following compounds (in reciprocal centigrade degrees): TiC (2.1×10^{-5}), ZrC (1.1×10^{-5}, HfC (1.0×10^{-5}), $VC_{0.98}$ (0.9×10^{-6}), $NbC_{0.99}$ (2.1×10^{-6}), TaC (5.0×10^{-6}), Cr_3C_2 (2.2×10^{-6}), Cr_7C_3 (3.1×10^{-6}), $Cr_{23}C_6$ (3.0×10^{-7}), Mo_2C (7.6×10^{-6}), WC (0.9×10^{-4}), W_2C (3.0×10^{-6}), $ScN_{0.98}$ (0.8×10^{-4}), $TiN_{0.98}$ (1.2×10^{-5}), $ZrN_{0.98}$ (4.0×10^{-6}), $HfN_{0.86}$ (1.2×10^{-6}), $VN_{0.93}$ (2.2×10^{-6}), $NbN_{1.00}$ (3.1×10^{-7}), $TaN_{1.01}$ (2.3×10^{-7}), and $CrN_{0.93}$ (1.4×10^{-4}). In general, the figure of merit was low, and was in agreement with the metallic nature of these compounds. The thermal emf of these refractory compounds tended to increase, and the specific electric resistance tended to decrease with increasing acceptor capacity of the transition metal constituent of the compound as given by the criterion $\xi = 1/Nn$. N is the principal quantum number of the partially filled d-shell of the metal atom, and n is the number of electrons in the d-shell of the free atom. A plot of lg Z versus ξ showed that lg Z increases with increasing value of ξ. It was noted that scandium nitride, which has an almost vacant d-shell and, as a consequence, a very high acceptor capacity, shows a very high figure of merit (0.8×10^{-4} deg^{-1}) for a metallic substance. (TTT)

2285 THE STATE OF RADIOACTIVE ISOTOPES IN VERY DILUTE SOLUTIONS AS STUDIED BY A DIFFUSION METHOD. I. E. Starik, F. L. Ginzburg, and B. N. Raevskii. Dokl. Akad. Nauk SSSR, 157: 926-9(Aug. 1, 1964). (In Russian)

The diffusion of radioisotopes ^{137}Cs, ^{90}Sr, ^{144}Ce, ^{234}Th, ^{239}Pu, and ^{95}Zr in very dilute solutions containing $<10^{-5}$ gram-ion/liter was determined for use in studying polymerization of the hydrolysis product, and estimating the average ionic charge. The value of $D\eta/T$ was plotted as a function of the square root of the hydrogen ion concentration $[H^+]^{0.5}$, where D is the diffusion coefficient and η is the viscosity. A sharp increase in particle radius was observed near 0.3N HCl for Zr[IV], above pH 1.4 for Pu(IV), and at about pH 3.7 for Th(IV). At these inflection points, the solubility products were calculated to be SP = 1×10^{-46} for $Th(OH)_4$, 1×10^{-55} for $Pu(OH)_4$, and 1×10^{-59} for $Zr(OH)_4$. These values were in good agreement with the literature values. It was proposed on the basis of previous work that true, positively-charged colloids are formed in this case. The existence of true colloids was determined only by the acidity of the solution. The charge of Sr(II), Ce(III), and Th(IV) was estimated from the Nernst equation: $|z| = (RT\lambda_0/D_0F^2)$. It was found that the average charge is 2.0 for Sr(II), 3.0 for Ce(III), 2.4 for Th(IV), 2.2 for Pu(IV), and nearly zero for Zr(IV). Thus, the average charge of an ion in a dilute solution could be estimated by measuring D as a function of the concentration of the diffusing ion. (TTT)

2286 PHASE DIAGRAMS AND ORDER OF SEPARATION DURING SOLVENT EXTRACTION. A. V. Nikolaev (Inst. of Inorganic Chemistry, Academy of Sciences, Siberian SSR). Dokl. Akad. Nauk SSSR, 157: 1156-9(Aug. 11, 1964). (In Russian)

A new method of presenting solvent extraction data is presented. The separation coefficient $\beta = K'_{dist.}/K''_{dist.}$ is plotted in place of the distribution coefficient. Four types of separation diagrams are obtained. In type I the separation coefficient β does not depend on the concentration of the second component. In type II, the value of β (the separation coefficient) increases with increasing concentration of the component which accumulates in the raffinate (a salting-out effect). In type III the value of β decreases with increasing concentration of the component left in the raffinate. Type IV is intermediate between types II and III. With type IV systems it is possible to concentrate both components in the raffinate under specified conditions. The following nine systems were plotted in this fashion (the maximum and minimum values of β and the type of system as characterized above are given in parentheses after the system): $Th(NO_3)_4$–$Ce(NO_3)_4$–H_2O–TBP (type I, 256 and 3.6); $UO_2(NO_3)_2$–$Ce(NO_3)_4$–H_2O–TBP (type I, 4.65 and 0.9); HNO_3–$UO_2(NO_3)_2$–H_2O–TBP (type I, 27,000 and 3.5); HNO_3–$Ce(NO_3)_4$–H_2O–TBP (type I, 234 and 1.91); HNO_3–$Th(NO_3)_4$–H_2O–TBP (type I, 51.4 and 2.3); HNO_3–UO_2–$(NO_3)_2$–H_2O–TBP (type I, 222.0 and 1.6); $La(NO_3)_3$–HNO_3–H_2O–TBP (type II, 12.3 and 0.4); $Th(NO_3)_4$–$UO_2(NO_3)_2$–H_2O–TBP (type III, 41.4 and 7.3); and HCl–$FeCl_3$–H_2O–$(C_2H_5)_2O$ (type IV, 232 and 0.1). Possible separations in the above systems are discussed. (TTT)

2287 THE INTERACTION OF RARE EARTHS WITH A CERIUM–MOLYBDENUM HETEROPOLYCOMPOUND. E. A. Torchenkova, G. G. Stepanova, and Vikt. I. Spitsyn (Inst. of Physics and Chemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 157: 1167-70(Aug. 11, 1964). (In Russian)

Freshly-prepared cerimolybdic acid (CMA) $CeO_2 \cdot 12MoO_3 \cdot nH_2O$ or the ammonium salt $3(NH_4)_2O \cdot CeO_2 \cdot 12MoO_3 \cdot 11H_2O$ was reacted with pure La, Ce, Pr, Sm, Y, Er, and Yb in a chloride or nitrate solution. A yellow precipitate having the composition $1.5\ Re_2O_3 \cdot CeO_2 \cdot 12MoO_3 \cdot nH_2O$ was obtained with the members of the cerium group of rare earths La, Ce, Pr, and Sm, as shown by chemical analysis. The yttrium group of rare earth elements did not precipitate with CMA (the ceric molybdenum heteropolycompound). The solubility of the lanthanum salt $1.5\ La_2O_3 \cdot CeO_2 \cdot 12\ MoO_3 \cdot 23H_2O$ is 0.0937 g/l at 20°C. Electromigration experiments with trivalent tagged ^{141}Ce showed that Ce(III) is in the form of an anionic complex after adding DMA to the solution. The polynuclear complex containing a trivalent rare earth as a constituent gives an insoluble precipitate, when the third rare earth atom reacts with the polynuclear complex. (TTT)

2288 THE PREPARATION OF A NUMBER OF Pu(V) COMPOUNDS. A. D. Gel'man and V. P. Zaitseva (Inst. of Physics and Chemistry, Academy of Sciences, USSR). Dokl. Akad. Nauk SSSR, 157: 1403-5(Aug. 21, 1964). (In Russian)

The region of maximum stability of Pu(V) solutions was determined by running the following experiments: the Pu concentration was held constant, and the pH of the solution was varied; the pH of the solution was held constant, and the Pu concentration was varied. The maximum stability of Pu(V) solutions was observed at a pH of 3.5 to 4.5 and

a Pu content of <2.5 g/l. Pu(V) solutions were prepared by reduction of Pu(VI) with hydrogen peroxide. Various Pu(V) compounds were isolated and subjected to chemical analysis. A grey-white carbonate compound had a composition of $NH_4PuO_2CO_3 \cdot 3H_2O$, and a solubility of $\sim 1.5 \times 10^{-4}$ mol/l in water. A compound with the composition $NH_4PuO_2F_2$ was obtained by reacting NH_4F with a nitric acid solution of Pu(V). Compounds having the composition $NH_4PuO_2C_2O_4 \cdot 6H_2O$ and $NH_4PuO_2HPO_4 \cdot 4H_2O$ were isolated by treating a Pu(V) solution with the corresponding ammonium salt. The Pu(V) iodate was found to be insoluble in water, but the composition of the compound was not established. A Pu(V) hydroxide having the composition $PuO_2(OH)$ begins to precipitate at a pH of ~6.8. The calculated solubility product of the Pu(V) hydroxide is $\sim 0.5 \times 10^{-9}$. (TTT)

2289 ON THE MECHANISM OF "THREE-ALKYL" ISOTOPE EXCHANGE OF ORGANO-MERCURIC COMPOUNDS. T. P. Karpov, V. A. Malyanov, E. V. Uglova, and O. A. Reutov (Moscow State Univ.). Izv. Akad. Nauk SSSR, Ser. Khim., No. 9, 1580-3(Sept. 1964). (In Russian)

Kinetics of isotopic exchange was studied using mercury-203 and mercury dialkyl and mercury alkyl halides with isoheptylene mercury organic compounds. The general exchange was second order; first order for each of the components. (R.V.J.)

2290 REACTIONS OF ISOTOPIC OXYGEN EXCHANGE IN $O_2-Nd_2O_3$ AND $O_2-Er_2O_3$ SYSTEMS. Kh. M. Minachev, G. V. Antoshin, and E. A. Nasedkin (Zelinskii Inst. of Organic Chemistry, Academy of Sciences, USSR). Izv. Akad. Nauk SSSR, Ser. Khim., No. 9, 1715-17(Sept. 1964). (In Russian)

The kinetics of exchange between molecular oxygen and neodymium and erbium oxides do not conform to the first order equation. However, the first order equation describes the kinetics of homomolecular exchange of Nd_2O_3 and Er_2O_3 and oxygen with a constant ^{18}O content. Temperature variations between 500 and 700°C did not effect the exchange. (R.V.J.)

2291 STUDIES OF LITHIUM HYDRIDE SYSTEMS. I. SOLID–LIQUID EQUILIBRIUM IN THE LITHIUM CHLORIDE–LITHIUM HYDRIDE SYSTEM. Carl E. Johnson, Scott E. Wood, and Carl E. Crouthamel (Argonne National Lab., Ill.). Inorg. Chem., 3: 1487-91(Nov. 1964).

Thermal analysis was used to determine the temperature–composition solid–liquid equilibrium diagram for the lithium hydride–lithium chloride binary mixture. A eutectic composition of 34.0 mole % lithium hydride was observed, melting at 495.6°C. No formation of solid solutions was observed. Calculations were made of the chemical potential for each component in the composition region for their solid–liquid equilibrium. The system exhibits positive deviations from ideal behavior. The positive deviations in the dilute solutions of lithium chloride in lithium hydride might be interpreted in terms of dimerization of the lithium chloride. (auth)

2292 USE OF HIGH-SURFACE-AREA SODIUM FLUORIDE TO PREPARE $MF_6 \cdot 2NaF$ COMPLEXES WITH URANIUM, TUNGSTEN, AND MOLYBDENUM HEXAFLUORIDES. Sidney Katz (Oak Ridge National Lab., Tenn.). Inorg. Chem., 3: 1598-1600(Nov. 1964). (ORNL-P-95)

Successful preparation of $MF_6 \cdot 2NaF$ compounds by gas–solid reactions is shown to be dependent on the use of high-surface-area sodium fluoride and proper reaction temperatures. The reaction was fastest with UF_6 and proceeded most closely to completion, whereas with WF_6 and MoF_6 the reaction was slower and not as complete. No compound containing less MF_6 than the compound $MF_6 \cdot 2NaF$ was noted. The dissociation pressures were determined to be: UF_6 over $UF_6 \cdot 2NaF$ – $\log P_{mm} = 9.25 \pm 0.02 - (4.18 \times 10^3)/T_k$; WF_6 over $WF_6 \cdot 2NaF$ – $\log P_{mm} = 8.80 \pm 0.01 - (3.99 \times 10^3)/T_k$; and MoF_6 over $MoF_6 \cdot 2NaF$ – $\log P_{mm} = 8.27 \pm 0.07 - (2.87 \times 10^3)/T_k$. (auth)

2293 THE ABSORPTION SPECTRA OF URANIUM(V) COMPOUNDS. D. G. Karraker (E. I. duPont de Nemours & Co., Aiken, S. C.). Inorg. Chem., 3: 1618-22(Nov. 1964).

The absorption spectra of the uranium(V) ion in CCl_4 solutions of $UCl_5 \cdot SOCl_2$, and $[U(OC_2H_5)_5]_2$ were measured, and energy levels were assigned on the basis of a $5f^1$ configuration for the U(V) ion. Comparison of these energy levels with the theoretical levels for a $5f^1$ configuration was satisfactory, and the spin–orbit coupling constant for U(V) was calculated to be 1900 cm^{-1}. The shifts in the energy levels between the two compounds were interpreted to result from a 30% stronger field on the U(V) ion in $[U(OC_2H_5)_5]_2$. (auth)

2294 COMPLEXES OF THE LANTHANIDE ELEMENTS WITH KOJATE AND ACETYLACETONATE IONS. H. Yoneda, G. R. Choppin, J. L. Bear, and J. V. Quagliano (Florida State Univ., Tallahassee). Inorg. Chem., 3: 1642-4(Nov. 1964). (TID-20592)

The stability constants for the lanthanide complexes of both the kojate and acetylacetonate anions, measured in an aqueous perchlorate solution of 2.0 M ionic strength, are reported. Attempts were made to determine how the stability of the complex is affected by the gradual change in the radius of the cation and by the size of the chelate. (P.C.H.)

2295 THE SYNTHESIS AND CHARACTERIZATION OF CYCLOPENTADIENYL DERIVATIVES OF URANIUM AND THORIUM. Gary L. Ter Haar and Michael Dubeck (Ethyl Corp., Detroit). Inorg. Chem., 3: 1648-50(Nov. 1964). (TID-20698)

The preparation of tricyclopentadienyluranium n-butoxide, tri-cyclopentadienyluranium methoxide tricyclopentadienylthorium chloride, tricyclopentadienylthorium n-butoxide, and tricyclopentadienylthorium methoxide is described. Infrared, NMR, and x-ray data were taken and the similarities in structure between the U and Th compounds are discussed. The tricyclopentadienylthorium and uranium butoxides appear to be isostructural according to x-ray-powder patterns. Great similarity in d-values and their relative intensities indicate the two compounds have the same type of unit cell and molecular symmetry. It is speculated that the cyclopentadienyl rings and the alkoxide or chloride are arranged symmetrically about the central atom at the corners of a distorted tetrahedron in the manner proposed for tricyclopentadienyluranium chloride. (P.C.H.)

2296 SOLVENT EFFECTS ON THE PHOSPHORUS-31 CHEMICAL SHIFT IN TRIPHENYLPHOSPHINE OXIDE. Gary E. Maciel and Ronald V. James (Univ. of California, Davis). Inorg. Chem., 3: 1650-1(Nov. 1964).

A solvent-shift study of the ^{31}P resonance of triphenylphosphine oxide to determine if a behavior similar to that found in the >13C=O case, but more sensitive to solvent and more precisely defined, could be obtained. The ^{31}P chemical shifts of triphenylphosphine oxide were obtained in 1:20 mole ratio (solute:solvent) solutions of the oxide in a variety of solvents. Qualitatively the solvent effects observed in the case of ^{13}C and ^{31}P were strikingly similar. While a strict linear relationship does not exist between the two sets of shifts, a definite monotonic trend is apparent, with 1,4-dioxane the only solvent out of order. (P.C.H.)

2297 RARE EARTH COMPOUNDS. II. THE SERIES $YbLn_2S_4$. S. A. Ring and Melvin Tecotzky (Lockheed Missiles and Space Co., Palo Alto, Calif.). Inorg. Chem., 3: 1654-6(Nov. 1964).

Mixtures of trivalent ytterbium were heated, under vacuum, with other rare earth metal sulfides to obtain double sulfides with the ytterbium present in the divalent state. By this procedure a series of compounds with the nominal stoichiometry $Yb^{II}Ln_2S_4$ for Ln = La, Pr, Y, Ho, Er, and Tm were prepared with the x-ray-powder diffraction spectra identified. The known analogous compound $Yb^{II}Yb_2^{III}S_4$ was also prepared. The room temperature magnetic susceptibilities for the parent sulfides and for the fired compounds per mole of formula were: PrS_2, 4980; $YbLa_2S_4$, diamagnetic; $YbPr_2S_4$, 9000; YbY_2S_4, 1220; $Yb^{II}Yb_2^{III}S_4$ 15000; all values times 10^{-6} emu. Other properties are also discussed. (P.C.H.)

2298 ISOTROPIC SHIFTS OF SOME IONIC COMPLEXES OF COBALT(II) AND NICKEL(II): EVIDENCE FOR ION PAIRING. Gerd N. La Mar (Princeton Univ., N. J.). J. Chem. Phys., 41: 2992-8(Nov. 15, 1964).

Isotropic proton resonance shifts were observed for the ionic complexes, $[Bu_4N][(\phi_3P)CoI_3]$ and $[Bu_4N][(\phi_3P)NiI_3]$. In addition to the phenyl (ϕ) proton shifts for the complex anions, isotropic shifts were observed for the cation protons as well. These shifts for the tetra-n-butylammonium cations were interpreted as arising solely from a pseudocontact interaction with the metal in the complex anion through partial ion pairing in the deuterochloroform solutions. From the magnitudes of the shifts for the butyl protons, an estimate was made for the relative extent of g-tensor anisotropies for the two anionic complexes. The observed shifts for the phenyl protons were interpreted as arising from both contact and pseudocontact interactions. Based on the postulate that the unpaired spin will distribute itself in a like manner in a given ligand whether attached to cobalt or nickel, and using the estimate of the relative anisotropies of the two metals, the phenyl proton shifts are separated into their respective contact and pseudocontact contributions. The resulting unpaired spin densities on the phenyl rings compare well with those reported for the related bis(triphenylphosphine) complexes. (auth)

2299 NONEQUILIBRIUM THERMODYNAMICS OF CANONICALLY INVARIANT RELAXATION PROCESSES. Hans C. Andersen (Massachusetts Inst. of Tech., Cambridge), Irwin Oppenheim, Kurt E. Shuler, and George H. Weiss. J. Chem. Phys., 41: 3012-19(Nov. 15, 1964).

A relaxation process in which a dilute system is in weak interaction with a heat bath is termed canonically invariant if the time-dependent system distribution function maintains its canonical form throughout the relaxation process and is thus characterized by a time-dependent temperature. The nonequilibrium (i.e., time-dependent) thermodynamics of such canonically invariant relaxation processes are discussed. Explicit analytic forms were obtained for the partition functions Q(t), the system thermodynamic properties E(t), A(t), S(t), and $C_v(t)$, the global free energy and entropy $\mathscr{A}(t)$ and $\mathscr{S}(t)$, and their time derivatives for both classical and quantum systems. For quantum systems with a finite number of discrete energy levels, the above treatment is extended to include canonically invariant processes at negative absolute temperatures. Finally, it is demonstrated that an initial canonical distribution for a fixed S(0) extremizes the entropy production of systems exhibiting canonically invariant relaxation processes. (auth)

2300 INFRARED SPECTRUM OF HCO. Dolphus E. Milligan and Marilyn E. Jacox (National Bureau of Standards, Washington, D. C.). J. Chem. Phys., 41: 3032-6((Nov. 15, 1964).

HCO and DCO were prepared by the photolysis of HI (DI) and of H_2S (D_2S) in a CO matrix at 14 and at 20°K. The earlier infrared spectroscopic identification of these species was confirmed. The C=O stretching frequency of DCO has been revised to 1800 cm^{-1}. Unusually low C–H and C–D stretching frequencies, 2488 and 1937 cm^{-1}, respectively, are obtained. Observations on $H^{13}CO$ and $D^{13}CO$ support these assignments. Spectroscopic, kinetic, and electron spin resonance data all suggest that the C–H bond is exceptionally weak. Fermi resonance may occur between the C–D and C=O stretching modes of DCO. Evidence is presented suggesting that considerable activation energy is required for the reaction of H atoms with CO. (auth)

2301 MAGNETIC AND ELECTRICAL PROPERTIES OF SMALL DIATOMIC MOLECULES. I. DIAMAGNETIC SUSCEPTIBILITY, PHOTON-SHIELDING CONSTANT, AND ELECTRIC POLARIZABILITY OF THE HYDROGEN MOLECULE. James R. Hoyland (Argonne National Lab., Ill.). J. Chem. Phys., 41: 3153-8(Nov. 15, 1964).

An unambiguous exact variational procedure is given for the calculation of certain weak interaction energies starting from any given approximate ground-state wavefunction. The method is illustrated by numerous calculations on the hydrogen molecule using five different ground-state wavefunctions. (auth)

2302 STUDIES ON THE HYDROGEN EVOLUTION REACTION DOWN TO –150°C AND THE ROLE OF PROTON TUNNELING. B. E. Conway and M. Salomon (Univ. of Ottawa). J. Chem. Phys., 41: 3169-77(Nov. 15, 1964).

An investigation of the hydrogen evolution reaction (h.e.r.) at low temperatures down to –150°C is reported for two metals, Hg and Pt, The purpose of the investigation was to examine the kinetic behavior for evidence of proton tunneling. The H/D isotope effect at mercury at low temperatures and the heat of activation behavior do not support any significant contribution from proton tunneling in the reaction. The situation is not as clear, however, for the case of smooth platinum. On the basis of the observation of a linear Arrhenius relation for the heat of activation down to –150°C, it was concluded that a proton tunneling mechanism cannot be appreciable for the h.e.r. on smooth platinum in ethanolic solutions. (auth)

2303 CONCERNING THE MAGNETIC SUSCEPTIBILITY OF PRASEODYMIUM OXIDES. J. B. MacChesney, H. J. Williams, R. C. Sherwood, and J. F. Potter (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Chem. Phys., 41: 3177-8(Nov. 15, 1964).

Polycrystalline specimens of the compound PrO_2 were prepared at high oxygen pressures (200–2000 atm). The phase so formed appears to be antiferromagnetic with a Néel temperature at 14°K. In contrast to this, measured susceptibilities of PrO_2 prepared at lower oxygen pressures are reported to indicate the absence of cooperative effects. Phase relations of the system praseodymium–oxygen were examined to explain the discrepancy between the two data. (auth)

2304 QUANTUM CELL MODEL. I. THE UNIFORM POTENTIAL APPROXIMATION. Ian H. Hillier and John Walkley (Imperial Coll. of Science and Tech., London). J. Chem. Phys., 41: 3205-12(Nov. 15, 1964).

The equation of state and related thermodynamic properties were calculated for a uniform potential approximation to the Lennard-Jones cell theory model employing quantum statistical mechanics. The simple form of the cell potential for this model allows the energy eigenvalues to be readily computed. A comparison to the available experimental compressibility data for hydrogen and deuterium is given. (auth)

2305 SPECTRA AND ENERGY LEVELS OF Eu^{3+} IN Y_2O_3. N. C. Chang (Aerospace Corp., El Segundo, Calif.). and J. B. Gruber. J. Chem. Phys., 41: 3227-34(Nov. 15, 1964).

The absorption and fluorescence spectra of Eu^{3+} in single crystals of Y_2O_3 were observed and analyzed. The intermediate-coupling free-ion energy levels for Eu^{3+}, including the effects of the 46 singlet states of the $4f^6$ configuration, are presented for all levels appearing below 41,000 cm^{-1}. The results obtained by including the singlet states in the free-ion energy level calculations are discussed. Values of $E^1 = 6217.84\ cm^{-1}$, $E^2 = 38.94\ cm^{-1}$, $E^3 = 630.15\ cm^{-1}$, and $\zeta = 1343.1\ cm^{-1}$ were found to give the best over-all agreement between the observed and calculated energy levels. (auth)

2306 RADIATIONLESS TRANSITIONS AND DEUTERIUM EFFECT ON LUMINESCENCE OF SOME AROMATICS. E. C. Lim and Joseph D. Laposa (Loyola Univ., Chicago). J. Chem. Phys., 41: 3257-9(Nov. 15, 1964).

Studies were made to determine if the observed deuterium effect on triplet-state lifetimes arises entirely from the mass dependence of radiationless transition and to examine the possible existence of a significant $S_1 \rightarrow S_0$ (lowest excited singlet to ground singlet) radiationless transition. The results showed that the fluorescence quantum yields of phenanthrene and triphenylene are not affected by the isotopic substitution, suggesting strongly the absence of any significant deuterium effect on $S_1 \rightarrow T_1$ radiationless transition. The results also rule out the presence of a $S_1 \rightarrow$

S_0 radiationless transition that can compete favorably with the $S_1 \rightarrow T_1$ radiationless transitions. The observed isotope effect on the fluorescence quantum yield of naphthalene can best be ascribed to the isotope effect on the $S_1 \rightarrow T_1$ radiationless transition. The results suggest the relative unimportance of the $S_1 \rightarrow S_0$ radiationless transition and the absence of a significant deuterium effect on the $S_1 \rightarrow T_1$ radiationless transition among aromatic hydrocarbons and their derivatives. The results are in accord with the Robinson-Frosch theory of electronic energy relaxation. (P.C.H.)

2307 RE-EXAMINATION OF THE NEUTRON DIFFRACTION RESULTS FOR TANTALUM DEUTERIDE Ta_2D. Gus J. Palenik (Naval Ordnance Test Station, China Lake, Calif.). J. Chem. Phys., 41: 3260-1(Nov. 15, 1964).

Previous results (Wallace, J. Chem. Phys., 35: 2156 (1961)) on neutron diffraction studies on tantalum deuteride, Ta_2D, are discussed. A comparison was made of observed relative intensities for β_1 Ta_2D. A proposed ordered structure is illustrated. (P.C.H.)

2308 CRYSTAL-FIELD SPLITTING OF TRIVALENT THULIUM AND ERBIUM ^2J LEVELS IN YTTRIUM OXIDE. John B. Gruber (Univ. of California, Los Angeles), William F. Krupke, and John M. Poindexter. J. Chem. Phys., 41: 3363-77(Dec. 1, 1964).

The optical absorption and fluorescence spectra of trivalent thulium in single crystals of yttrium oxide and the absorption spectrum of pure thulium oxide, were investigated. All the $4f^{12}$ electronic energy levels except the $^1S_0$ level were identified. The three Slater F_k parameters and the spin-orbit parameter ξ, giving the best over-all agreement between the observed spectrum and the calculated spectrum are: $F_2 = 446.70\ cm^{-1}$, $F_4 = 70.491\ cm^{-1}$, $F_6 = 7.534\ cm^{-1}$, and $\xi = 2617\ cm^{-1}$. A detailed crystalline-field splitting perturbation calculation was carried out for trivalent thulium and trivalent erbium ions in the C_2 sites of the Y_2O_3 lattice. The predicted crystalline-field splitting for these ions was compared with the thulium data and with the erbium data. The average deviations between the predicted and the observed splittings for 71 crystalline Stark levels in the Tm^{3+} spectrum and 65 levels in the Er^{3+} spectrum, are 13 and 11 cm^{-1}, respectively. (auth)

2309 LOW-TEMPERATURE OBSERVATION OF OXYGEN-17 NMR IN H_2O, D_2O, AND EUTECTIC SOLUTIONS. Sherman W. Rabideau and Jasper A. Jackson (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys., 41: 3405-7 (Dec. 1, 1964). (LA-DC-6517)

Although linewidths for the oxygen-17 resonance were recorded in supercooled H_2O and D_2O, it was not possible to obtain a signal from these pure solids. Linewidth measurements were also made to −79°C in a LiI-H_2O eutectic solution. Ice with ~10% ammonium fluoride in solid solution did not display the ^{17}O resonance below the eutetic temperature. The deuterium resonance in a 0.15M NaCl-D_2O solution was used to demonstrate the presence of liquid eutectic solution in polycrystalline ice. (auth)

2310 NUCLEAR MAGNETIC RESONANCE OF SINGLE CRYSTALS OF D_2O ICE. Peter Waldstein, Sherman W. Rabideau, and Jasper A. Jackson (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys., 41: 3407-11(Dec. 1, 1964). (LA-DC-6513)

Quadrupole splitting of the deuteron magnetic resonance was measured in single crystals of solid D_2O at −10°C. For deuterons on the hexagonal crystal axis, eQq_1/h equaled 213.2 ± 0.8 kc/sec, and $|\eta_1|$ was equal to 0.100 ± 0.002. For the other deuterons, eQq_2/h was found to be equal to 216.4 ± 1.0 kc/sec. No change in the line separations was observed at a temperature of −70°C. No evidence was found for hindered rotation of the D_2O molecules nor for intermolecular deuteron transfer at −10°C. Lower limits to the barriers hindering these motions were estimated; these limits permit estimates to be made of hydrogen-bond energies. The coupling constants in the solid are about 30% less than those reported for the free molecule. Most of this decrease must be ascribed to electronic structural changes brought about as a result of hydrogen-bond formation. (auth)

2311 NUCLEAR QUADRUPOLE RESONANCE IN PARAMAGNETIC $PrCl_3$. W. E. Hughes, Charles G. Montgomery, W. G. Moulton, and E. H. Carlson (Univ. of Alabama, University). J. Chem. Phys., 41: 3470-3(Dec. 1, 1964).

The ^{35}Cl and ^{37}Cl pure quadrupole resonances were observed in $PrCl_3$. At 4.2°K the frequencies are 4.5667 ± 0.0001 and 3.6001 ± 0.0001 Mc/sec for ^{35}Cl and ^{37}Cl, respectively, and at 77°K they are correspondingly 4.5607 ± 0.0001 and 3.5955 ± 0.0002 Mc/sec. The orientation dependence of the Zeeman split quadrupole resonance frequencies was measured at 4.2°K and the components of the field gradient tensor determined. The asymmetry parameter η is 0.58 ± 0.02. No evidence of a transition to an ordered state was observed, and it was concluded that $PrCl_3$ remains paramagnetic down to 1.7°K. A shift in the Zeeman frequencies with temperature was found and is attributed to the hyperfine interaction of the Cl nuclei with the Pr electronic ground state. The results were compared with the results of a calculation of the field gradient from a point charge model, and are discussed in terms of covalent bonding. (auth)

2312 CRYSTAL STRUCTURE OF $Li_6BeF_4ZrF_8$. D. Richard Sears and John H. Burns (Oak Ridge National Lab., Tenn.). J. Chem. Phys., 41: 3478-83(Dec. 1, 1964). (ORNL-P-192)

The crystal structure of $Li_6BeF_4ZrF_8$ was determined by x-ray diffraction. The tetragonal unit cell, having a = 6.57, c = 18.62 Å, contains four formula weights; the space group is $D_{4h}^{19}-I4_1$ amd. Discrete BeF_4^{2-} and ZrF_4^{4-} ions are connected by shared Li^+ ions. The BeF_4^{2-} tetrahedron is quite regular with a Be-F distance of 1.57 ± 0.01 Å; the ZrF_4^{4-} dodecahedron has two independent Zr−F bonds of 2.05 ± 0.01 Å and 2.16 ± 0.01 Å, and deviates considerably from the shape predicted by theory. (auth)

2313 ^{13}C AND ^{18}O ISOTOPE EFFECTS IN THE DECARBOXYLATION OF QUINALDIC ACID. Mieczyslaw Zielinski (Univ. of Chicago). J. Chem. Phys., 41: 3646-8 (Dec. 1, 1964).

Both ^{13}C and ^{18}O isotope effects were measured in the decarboxylation of samples of quinaldic acid as a representative of zwitterions or internally bridged molecules. The $k^{12}C/k^{13}C$ ratios in the case of the decarboxylation of quinaldic acid are much lower than published data for the decarboxylation of malonic and other acids. Such a comparison could not be made for ^{18}O secondary isotope effects since corresponding data in the literature could not be found. (P.C.H.)

2314 LOW-FREQUENCY MOLECULAR VIBRATIONS IN SOLID HEXANE BY NEUTRON INELASTIC SCATTERING. H. R. Danner (Univ. of Missouri, Columbia), H. Boutin, and G. J. Safford. J. Chem. Phys., 41: 3649-50(Dec. 1, 1964).

Measurements were made to determine the low-frequency vibrational modes in n-C_6H_{14} at a temperature sufficiently below its melting point so that the effect of internal rotations may be assumed to be negligible. The neutron spectrum of n-C_6H_{14} at room temperature is characterized by a broad inelastic distribution peaked approximately at kT (25 Mev) and the absence of an elastic peak at $E = E_0$ (=5.2 Mev). The frequency distribution of the molecular vibrations in n-hexane at 125°K shows a number of distinct components. (P.C.H.)

2315 THE VAPOR PRESSURE AND HEAT OF SUBLIMATION OF SAMARIUM. C. C. Herrick (Los Alamos Scientific Lab., N. Mex.). J. Less-Common Metals, 7: 330-5(Nov. 1964). (LADC-6338)

The vapor pressure of samarium metal was investigated in the temperature range 928−1160°K. The vapor pressure (in atmospheres) is represented by the relation $-R \ln P = 4.817_6 \cdot 10^4/T - 25.191$, over the temperature range cited. The second-law heat of sublimation is 49.19 kcal/mole computed at 298°K, and the third-law heat is 49.43 kcal at 298°K. Extrapolation of the data yields a normal boiling point of 2077°K. (auth)

2316 THE ISOTOPIC EXCHANGE REACTION BETWEEN U(IV) AND U(VI) IONS IN A MIXED SYSTEM OF

ACIDIC SOLUTION AND CATION EXCHANGE RESIN. II. MECHANISM OF EXCHANGE REACTION IN HOMOGENEOUS PHASE. Junichi Shimokawa and Gunji Nishio (Japan Atomic Energy Research Inst., Tokyo). J. Nucl. Sci. Technol. (Tokyo), 1: 221-7(Oct. 1964).

The mechanism of the exchange of uranium isotopes between U(IV) and U(VI) ions in resinous phase was investigated, and analysis of the results also led to a clearer understanding of the nature of isotopic exchange in solution systems containing no resin. From the consideration that the rate of isotopic exchange in the homogeneous phase is dependent on the degree of hydrolysis of tetravalent uranium: $U^{4+} + n \cdot H_2O \rightleftharpoons U(OH)_n^{(4-n)+} + n \cdot H^+$ the following approximate equation was derived for the apparent exchange rate constant: $k = K_{h,p}k_4/[H^+]^p[1 + \Sigma_{n=1}^{3} K_{h,n}/[H^+]^n]$. At moderate acidities, the apparent exchange rate is inversely proportional to the third power of hydrogen ion concentration in both the resinous phase and the solution system. Isotopic exchange occurs most readily between U(VI) and the hydrolyzed complex $U(OH)_3^+$ of U(IV). The apparent rate constant for the isotopic exchange in the resinous phase is larger than that in the solution system by 3 to about 4 orders of magnitude. The cation exchange resin used seems to have a catalytic property that accelerates the isotopic exchange. (auth)

2317 THE VISIBLE AND ULTRAVIOLET ABSORPTION SPECTRA OF UO_2. Shōichi Nasu (Japan Atomic Energy Research Inst., Tokyo). J. Phys. Soc. Japan, 19: 1753-4(Sept. 1964).

The visible and u-v absorption spectra of UO_2 single crystals produced by arc-fusing and sintering techniques were measured at temperatures from 77 to 548°K. (D.C.W.)

2318 CATALYTIC ACTIVITY OF RARE-EARTH COMPOUNDS IN DIRECTIONAL POLYMERIZATION. Chih-chuan Shen, Chung-yuan Kung, Chung-chi Chung, and Ou-yang Chun. K'o Hsueh T'ung Pao, No. 4, 335-6(1964).

The catalytic activity of the heterogeneous rare earth alkyl aluminum systems was investigated in directional polymerization of 1,3-butadiene and it was found that some systems have high directional functions. Polymerization of 1,3-butadiene was carried out in nitrogen. Water and impurities in a 1,3-butadiene–benzene solution were removed by letting the solution flow through an activated aluminum oxide column. Anhydrous chlorides of 9 rare earths (Y, La, Pr, Nd, Ce, Sm, Gd, Er, and Yb) were investigated for their catalytic activity with triethyl aluminum. The YCl_3–$Al(C_2H_5)_3$ system was found to possess the highest catalytic activity. The cis-1,4 content in a polymer obtained from the YCl_3–$Al(C_2H_5)_3$ may reach as high as 94% and product polybutadiene has a molecular weight of 300,000–600,000. The polymerization rate of 1,3-butadiene was found to increase with the increasing Al/Y molar ratio until a ratio of 60 is reached. The $YCl_3 \cdot 3C_5H_5N$–$Al(C_2H_5)_3$ system can also catalyze the polymerization of 1,3-butadiene and cis-1,4 polymer obtained may reach as high as 95%. Polymerization usually takes place on the surface of catalysts. The resulting polymers appear in the form of a gelatin and retain most of the catalytic property in their surface structure. The yttrium chloride–alkyl aluminum systems have a higher catalytic activity than the corresponding yttrium oxide systems. A change of alkyl radicals in alkyl aluminum greatly affects the activity of catalysts. Both the YCl_3–$Al(C_2H_5)_2Cl$ and YCl_3–$Al(C_2H_5)Cl_2$ systems exhibit no catalytic activity. YCl_3–$Al(i-C_4H_9)_3$ has a lower catalytic activity than YCl_3–$Al(C_2H_5)_3$. (OTS)

2319 PREPARATION AND PROPERTY DETERMINATION OF SOME RARE-EARTH TITANATES. Hui-min Chang. K'o Hsueh T'ung Pao, No. 5, 54-7(1964).

Titanates of lanthanum, cerium, praseodymium, neodymium, and yttrium were prepared and their physical and chemical properties determined. Materials used and their purities were: La_2O_3 (98%), CeO_2 (99% and spectrally pure), Pr_6O_{11} (99.9%), Nd_2O_3 (99.9%), YO_3 (spectrally pure), and TiO_2 (99% and spectrally pure). Samples were prepared by pulverizing the materials in an agate mortar and heating in a platinum filament heater at 1500°C. Samples were analyzed by an ion exchange method for rare earths and titanium oxides. The composition of samples was determined by an x-ray-diffraction powder method, and magnetic susceptibility was determined by a Suck-Smith's magnetic scale. The electric resistance was measured by an ohmmeter and the thermoelectric potential by a 303 type potentiometer. Dielectric constants were determined by the Starke submersion method. Experimental results showed that lanthanum titanate can be obtained at 1500°C in 1 hr., praseodymium and neodymium titanates in 2 hr, and yttrium titanate in 0.5 hr; lanthanum, neodymium, and praseodymium titanates may form torsional pyrochlore-type compounds with TiO_2 and yttrium titanate forms a cubic pyrochlore compound with TiO_2; rare-earth titanates have high melting points and are chemically stable and insoluble in acid or basic media; only yttrium titanate has a specific resistance in the semiconductor range. (OTS)

2320 HYPERSENSITIVE PSEUDOQUADRUPOLE TRANSITIONS IN LANTHANIDES. Chr. Klixbuell Joergensen (Cyanamid European Research Inst., Cologny, Switzerland) and B. R. Judd. Mol. Phys., 8: 281-90(1964).

It is pointed out that the absorption lines of the lanthanides that are peculiarly sensitive to changes in the ligands are consistent with the selection rules for quadrupole radiation within the 4f shell. A number of sources for this sensitivity were examined, and it was concluded that it owes its origin to the inhomogeneity of the dielectric. According to this mechanism, there is an asymmetrical distribution of the dipoles induced by the electromagnetic field in the medium surrounding a lanthanide ion. The variation across the lanthanide ion of the electric vector is much greater than for the case of a homogeneous dielectric, and the intensities of quadrupole transitions are enormously enhanced. (auth)

2321 COMPLEXES OF URANYL NITRATE WITH TRIBUTYLPHOSPHATE. Jerzy Michalczyk and Jozef Hurwic (Politechnika Warszawska, Warsaw). Nukleonika, 9: 483-4(1964). (In Polish)

2322 DIPOLE MOMENT OF $Th(NO_3)_4 \cdot 2TBP$. Jozef Hurwic, Stefania Jarzynska, and Jerzy Michalczyk (Politechnika Warszawska, Warsaw). Nukleonika, 9: 484-5 (1964). (In Polish)

2323 DIPOLE MOMENT OF $La(NO_3)_3 \cdot 3TBP$. Jozef Hurwic, Stefania Jarzynska, and Jerzy Michalczyk (Politechnika Warszawska, Warsaw). Nukleonika, 9: 486(1964). (In Polish)

2324 THE INTERFUSION EFFECT IN MEMBRANE KINETICS. Andrzej Plonka (Technical Univ., Lodz, Poland and Military Academy of Medicine, Lodz, Poland). Nukleonika, 9: 487-9(1964).

In a linear transfer system-phase I, membrane, phase II— the rate of dilution of a tagged substance in phase I determines the transfer of the substance from phase II, and the disappearance rate of the tagged substance from phase I determines the transfer of the substance to phase II. About 7 μl of $^{22}NaCl$ were added to phase I in a system containing (concentration in mmoles Na per liter) NaCl or H_2O. The activity of phase I was then measured by a scintillation counter. For all experiments the activity of phase I decreased exponentially with time. It was concluded that the interfusion effect, which was found in the experiments, is probably common to all the systems proceeding to a state of greater chaos, and controls the rate of exchange. (P.C.H.)

2325 RADIAL DISTRIBUTION FUNCTIONS OF LIQUID KRYPTON. Ashfaq A. Khan (Univ. of Florida, Gainesville). Phys. Rev., 136: A1260-79(Nov. 30, 1964).

Radial distribution functions g of liquid krypton have been computed at several values of temperature and density from the Percus-Yevick (PY) (Phys. Rev. 110: 1(1958) and Phys. Rev. Letters 8: 462(1962)) and the convolution-hypernetted-chain (CHNC) integral equations using two different interaction potentials [the Lennard-Jones (LJ) and one other] between the krypton atoms. The computed g's are compared with the neutron diffraction experimental g's. From the

computed g's, quantities i(s), which are directly proportional to the experimentally measured quantities (the number of counts/min), have been computed and are compared with the experimental values. Besides this, computations have been done to investigate: the behavior of the computed g's with the variation in the range of integration; the changes in the computed g's with the long-range part of the interaction potential; and the cause of irregularities in the experimental g's. The g's computed with the CHNC equation and LJ potential agree with the experimental g's except near the critical temperature. The effect on the computed g's of varying the long-range part of pair potential is small. The major cause of the irregularities in the experimental distribution functions is inherent in the experimentally measured intensity curves and not in the truncation error. (auth)

2326 HYPERFINE STRUCTURE OF V_k CENTERS IN ALKALI FLUORIDE CRYSTALS. C. Edward Bailey (Dartmouth Coll., Hanover, N. H.). Phys. Rev., 136: A1311-16(Nov. 30, 1964).

V_k centers in LiF, NaF, KF, RbF, and CsF are studied. It is shown that the V_k center is stable in all the alkali fluorides at liquid-nitrogen temperature and unstable at room temperature. The predictions of the theoretical Hamiltonian are in agreement with all of the experimental results. Values of $g_{\parallel}$, $g_{\perp}$, a, and b are presented for NaF and KF. It is shown that the linewidths of the V_k spectrum depend rather heavily on the nearest-neighbor atoms (the alkalis), and the relaxation process seems to be one of hyperfine coupling. (auth)

2327 SPIN-LATTICE RELAXATION OF F CENTERS IN KCl: INTERACTING F CENTERS. R. W. Warren, D. W. Feldman, and J. G. Castle, Jr. (Westinghouse Electric Corp., Pittsburgh). Phys. Rev., 136: A1347-58(Nov. 30, 1964).

Spin relaxation of F centers in KCl has been observed by a field-sweep inversion recovery technique at liquid-helium temperatures. Various kinds of extrinsic behavior are reported. They include distorted resonance line shapes, unusually fast relaxation, and unusual field and temperature dependences of the relaxation. Such effects were always seen at low temperatures and low fields after the following treatments: high F-center concentrations; light exposure; the addition of certain impurities; plastic deformation; and low-temperature gamma irradiation. A model is presented that explains all of these effects and is consistent with the extensive lore involving the properties of F centers. This model identifies the extrinsic relaxation process as one compounded of spatial diffusion of Zeeman energy in the F-center system and cross relaxation from F centers to rapidly relaxing centers. These rapidly relaxing centers are composed of loosely bound clusters of F centers, which can be formed in a variety of ways. (auth)

2328 ELASTIC CONSTANTS OF STRONTIUM FLUORIDE BETWEEN 4.2 AND 300°K. D. Gerlich (RCA Labs., Princeton, N. J.). Phys. Rev., 136: A1366-8(Nov. 30, 1964).

The elastic constants of single-crystal SrF_2 have been determined over the temperature range 4.2 to 300°K, by an ultrasonic pulse-echo technique. The values of the elastic constants, extrapolated to 0°K, in units of 10^{11} dyn/cm^2, are: $c_{11} = 12.88$, $c_{12} = 4.748$, and $c_{44} = 3.308$. From these values, a Debye temperature of 380°K is calculated for SrF_2 at 0°K. The elastic constants of SrF_2 are computed theoretically from a rigid-ion model, and the results are compared with the experimentally measured values. The elastic constants of SrF_2 are compared with those of the other alkaline-earth fluorides. (auth)

2329 BOLTZMANN EQUATION IN A PHONON SYSTEM. C. Horie and J. A. Krumhansl (Cornell Univ., Ithaca, N. Y.). Phys. Rev., 136: A1397-1407(Nov. 30, 1964). (TID-20848)

The Green's function approach is developed to derive the Boltzmann equation for a phonon system having cubic anharmonic interactions. Within the framework of the lowest order scattering process, it is found that the steady-state Boltzmann equation obtained is identical with the Peierls integral equation, except for small correction terms. These correction terms can be absorbed into the transport term by replacing the phonon group velocity appearing in the transport term by the renormalized one, including kinetic and dynamical effects of collisions. Several remarks are made on the generalization of the Boltzmann equation. (auth)

2330 ELECTRON SPIN RESONANCE OF NEUTRAL HYDROGEN ATOMS IN SrF_2 AND BaF_2. Benjamin Welber (International Business Machines Corp., Yorktown Heights, N. Y.). Phys. Rev., 136: A1408-12(Nov. 30, 1964).

The electron-spin-resonance spectra of SrF_2 and BaF_2, each containing neutral hydrogen atoms in interstitial sites, are investigated. In all cases, the electron-proton contact hyperfine interaction is resolved. Also resolved are the smaller superhyperfine interactions with the nuclei of the eight neighboring F^- ions. It is found that the magnitude of these interactions is very sensitive to the host lattice. In particular, the superhyperfine interaction decreases by about a factor of two as one proceeds from smallest to largest lattice parameter. It is also found that the difference between the electron-proton interaction parameter B and the corresponding quantity for the free atom is positive, and decreases from 39.9 ± 0.1 Mc for CaF_2 to about 4.1 ± 0.1 Mc for BaF_2 at room temperature. Forbidden transitions corresponding to simultaneous flips of the electron and an associated fluorine nucleus were also observed, and the intensity of these in terms of the effective magnetic fields acting on the F^- sites is discussed. (auth)

2331 RARE-EARTH IONS IN THE ALKALI HALIDES. I. EMISSION SPECTRA OF Sm^{2+}-VACANCY COMPLEX. W. E. Bron and W. R. Heller (International Business Machines Corp., Yorktown Heights, N. Y.). Phys. Rev., 136: A1433-44(Nov. 30, 1964).

Measurements have been made of the crystal-field splitting of the ^7F_J energy levels of the $4f^6$ configuration of the Sm^{2+} ion, which is dissolved in a number of alkali-halide lattices. Crystal-field term assignments were made from the results of polarized-emission measurements. Observed crystal-field splittings are compared to those predicted from point-charge models. Contributions to the total crystal field are considered to include that due to the presence of a nearest-neighbor cation vacancy as well as that due to displacements, from normal lattice positions, of the nearest-neighbor halide ions and the Sm^{2+} ion. The splitting is shown to arise in part from a displacement of the Sm^{2+} and the cation vacancy toward each other. The extent of the validity of the use of a point-charge model for this case is discussed. (auth)

2332 ELECTRIC QUADRUPOLE-QUADRUPOLE INTERACTION IN CERIUM ETHYL SULFATE. J. M. Baker (Univ. of California, Berkeley). Phys. Rev., 136: A1633-5 (Dec. 14, 1964).

Electron paramagnetic resonance (EPR) of cerium ethyl sulfate (CeES) below 2°K gives evidence of a large nondipolar interaction between nearest-neighbor cerium ions. Writing the spin hamiltonian for the interaction of two spins S_i and S_j as $\mathcal{H}_{ij} = (\alpha_{ij} + A_{ij})S_{iz}S_{jz} + \frac{1}{2}(\beta_{ij} + B_{ij})(S_{i+}S_{j-} + S_{i-}S_{j+})$, where α_{ij} and β_{ij} are the known contributions from dipole-dipole interaction, the experiments suggest that $A_{ij} = 0.105 \pm 0.003$ cm^{-1} and $B_{ij} = 0.073 \pm 0.003$ cm^{-1}. Although there is no proof, there are four pieces of evidence which strongly support the hypothesis that the interaction is due to electric quadrupole-quadrupole (QQ) interaction. Firstly, the order of magnitude of A_{ij} and B_{ij} are reasonable. Secondly, QQ interaction affords an explanation of the differences between the temperature dependence of the EPR spectra of diluted and undiluted CeES. Thirdly, the spectra of rare-earth impurities in CeES, and fourthly, the spectra of pairs of interacting cerium ions in dilute specimens, are consistent with QQ interaction. Finally, it is shown that superexchange and exchange of virtual phonons probably contribute very little to the observed interaction. (auth)

2333 POLARIZED-NEUTRON STUDY OF HEMATITE. R. Nathans (Brookhaven National Lab., Upton, N. Y.), S. J.

Pickart, H. A. Alperin, and P. J. Brown. Phys. Rev., 136: A1641-7(Dec. 14, 1964). (BNL-8163)

Polarized-neutron studies on natural and synthetic single crystals of hematite have shown that the 180° antiferromagnetic domain walls are removed in low fields as the parasitic ferromagnetism of the high-temperature phase is saturated, and the remaining 120° walls are removed by the application of higher fields. No memory effect was observed for the antiferromagnetic domain configuration as the crystal was cycled through the spin-axis transition temperature. The spin density of the ferromagnetic component of the spin system was found to be different from that of the antiferromagnetic component. (auth)

2334 CLUSTER APPROXIMATION FOR FERROMAGNETS WITH FIRST- AND SECOND-NEIGHBOR EXCHANGE, WITH APPLICATION TO THE EUROPIUM CHALCOGENIDES. Herbert B. Callen (Univ. of Pennsylvania, Philadelphia) and Earl Callen. Phys. Rev., 136: A1675-83(Dec. 14, 1964).

The two-particle cluster approximation of Strieb, Callen, and Horwitz is extended to ferromagnets and paramagnets with nearest- and next-nearest-neighbor exchange, with particular reference to EuO, EuS, EuSe, and EuTe. Curie temperatures, magnetization curves for general values of the applied field, susceptibility, spin-correlation functions, energy, and specific-heat curves are calculated. Using the values of the exchange constants of EuS obtained from low-temperature spin-wave analysis (and no adjustable constants) excellent agreement with the observed Curie temperature, very close agreement with the observed paramagnetic Curie temperature, and very good agreement with the λ-like discontinuity in the specific heat near the Curie temperature are found. The magnetization data for arbitrary applied fields and the susceptibility data in the paramagnetic region also can be fit closely with these values of the exchange constants. To explore the sensitivity of the theory to the exchange constants, the results of the cluster approximation are given for various ratios of the first- and second-neighbor exchange constants, including the special case of vanishing second-neighbor exchange (in this latter case the approximation generalizes the constant-coupling approximation to arbitrary spin). It is found that all the presently measured magnetic properties are rather insensitive to the particular choice of exchange constants, provided that these are chosen to be consistent with the observed Curie temperature; measurement of the spin-correlation functions, however, would provide a sensitive criterion for the choice of exchange constants. (auth)

2335 DEPENDENCE OF SPIN-LATTICE RELAXATION TIME UPON MAGNETIC FIELD FOR TWO SALTS OF NEODYMIUM. J. M. Baker and N. C. Ford, Jr. (Univ. of California, Berkeley). Phys. Rev., 136: A1692-1701 (Dec. 14, 1964).

Measurements made below 1.5°K of the spin-lattice relaxation rate T_1^{-1} of Nd^{3+} in lanthanum fluoride and lanthanum magnesium nitrate as a function of the separation δ of the levels of the ground doublet give clear evidence for a dependence $T_1^{-1} \propto \delta^5 \coth(\delta/2kT)$, as expected for the direct process. There is also a second contribution at lower fields in LaF_3, $T_1^{-1} \propto \delta^3 \coth(\delta/2kT)$, which is believed to arise from forbidden relaxation transitions in the neodymium ions which have a hyperfine structure. The relaxation rate for the forbidden transition was calculated, and it was shown that under certain circumstances it can be more rapid than the relaxation rate for allowed transitions. There is a third contribution which depends upon the concentration of Nd^{3+} and may be due to cross relaxation to coupled pairs of Nd^{3+} ions. In lanthanum magnesium nitrate there is a phonon bottleneck as well as the direct process. Both salts show an Orbach process above 2°K. A modification of the usual pulse saturation technique was used to obtain these measurements which gives some advantages over the standard method. (auth)

2336 ELECTRON PARAMAGNETIC RESONANCE OF IRON IN INDIUM ARSENIDE. Thomas L. Estle (Texas Instruments Inc., Dallas). Phys. Rev., 136: A1702-4(Dec. 14, 1964).

The electron-paramagnetic-resonance spectrum of the $3d^5$ configuration of iron in cubic symmetry was observed in iron-doped indium arsenide. The spin-hamiltonian parameters describing this spectrum are $g = 2.035 \pm 0.002$ and $a = +(421 \pm 1) \times 10^{-4}$ cm^{-1}. The inhomogeneously broadened line is approximately 130 G wide. A comparison is made with the Mössbauer effect of ^{57}Fe in InAs studied by Bemski and Fernandes. The results are discussed in terms of charge-transfer configuration admixtures introduced by Fidone and Stevens and elaborated by Watanabe and co-workers. (auth)

2337 MEASUREMENT OF MOLECULAR ROTATION BY N^{14} NUCLEAR QUADRUPOLE RESONANCE RELAXATION TIMES. S. Alexander and A. Tzalmona (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. Letters, 13: 546-7(Nov. 2, 1964).

The spin-lattice relaxation time in the pure quadrupole resonance of ^{14}N in hexamethylenetetramine. The measurements covered the temperature range of 77–327°K. It was found that molecular rotations dominate the relaxation time above 250°K. (C.E.S.)

2338 INVESTIGATIONS OF THE COLLOIDAL PROPERTIES OF POLONIUM-210 SOLUTIONS BY USING MOLECULAR FILTERS. P. E. Morrow, R. J. Della Rosa, L. J. Casarett, and G. J. Miller (Univ. of Rochester, N. Y.). Radiation Res., Suppl., 5, 1-15(1964).

Data are presented concerning the behavior of polonium in various solutions on filtration through molecular filters. A nonfilterable form of polonium characteristic of colloid was observed over a wide range of hydrogen ion concentration and found to be at a maximum at neutrality and in the absence of complexing electrolytes. Polonium solutions prepared in water, saline, and aqueous noncomplexing electrolytes between pH 5 and pH 9 will contain important amounts of colloidal polonium as measured by filterability. On the basis of the relation between the filterability characteristics of polonium and the results of other studies with polonium by centrifugation and dialysis methods and the evidence given by currently determined autoradiographic data, the molecular filter appears to be suitable for many studies of polonium colloid. Autoradiographic examination of filtered polonium indicated that an appreciable amount of the colloid consisted of between 700 and 2500 polonium atoms but that the predominant colloid was composed of fewer than 100 polonium atoms. Soluble complex forms of polonium citrate and in sodium carbonate were prepared. The citrate complex appears to be a form of polonium, compatible with biological use, that will be relatively free of colloid on administration. Some tests of the effects of ionic strength, polonium concentration, aging, and impurities on polonium filterability were made. Of these, the polonium concentration may be important, but the range used was too small for generalization. Aging polonium solution at neutral pH in glass is conducive to large losses by adsorption but did not produce much change in filterability of the unadsorbed fraction. (auth)

2339 SOME CHARACTERISTICS OF POLONIUM SOLUTIONS OF IMPORTANCE IN BIOLOGICAL EXPERIMENTS. R. G. Thomas and J. N. Stannard (Univ. of Rochester, N. Y.). Radiation Res., Suppl. 5, 23-8(1964).

The presence and formation of aggregates of polonium-containing particles in neutral solutions of polonium-210 were clearly demonstrated. The phenomenon was not seen with the acidified solutions. Each neutralized solution, prepared in essentially the same manner, may act differently with regard to initially sedimenting fraction and rate of subsequent aggregate formation. Aggregates are shown to form, in part at least, about foreign material. It is clear that these aggregates cannot be constituted solely of polonium atoms. The rate of aggregation, for a given solution, bears a relationship to time after neutralization. A need for standardization of injection solutions used in biological experimentation is again demonstrated. Futhermore, any in vitro work designed to explain in vivo data

must be extremely well controlled wherever any of these solutions parameters are likely to be involved. (P.C.H.)

2340 METHOD OF PREPARING SINGLE CRYSTALS OF LiF. Alonso Fernández and Hector Riveros (Universidad Nacional, Mexico City). Rev. Mex. Fis., 13: 31-8 (July 1964). (In Spanish)

Monocrystals of lithium fluoride have very useful characteristics to complete studies of electrical phenomena in solids, as it is possible to differentiate in them the dislocations newly produced by thermal treatment. In order to use such properties in the growth of LiF monocrystals, a radiofrequency oscillator was designed and constructed, which provides energy to an installation for growing crystals in controlled atmosphere. The basic design of the devices, the methods used to produce the monocrystals, and the results obtained are described. (tr-auth)

2341 VIBRATIONAL EXCITATION IN SOME FOUR-CENTER TRANSITION STATES. S. H. Bauer and E. L. Resler, Jr. (Cornell Univ., Ithaca, N. Y.). Science, 146: 1045-8(Nov. 20, 1964).

The rates of substitution of deuterium for hydrogen in homogeneous gas-phase reactions between D_2 and HX (X = H, Cl, NH_2, or HS) were measured at high temperatures by single-pulse shock tube techniques. The magnitudes observed and their dependency on concentration indicate that the rates of exchange are much faster than would be attainable were the deuterium to dissociate and the D atoms to react with HX by atomic displacement to produce H + DX. Also, these rates were not limited by methathesis through four-center transition states generated by sufficiently energetic collisions between the principal reactants. The results are compatible with the assumption that the rates are controlled by the populations of D_2 in about its 6th vibrational energy level. (auth)

2342 OXIDATION KINETICS OF COPRECIPITATED (URANIUM, PLUTONIUM) O_2 POWDERS AND SINTERED PELLETS. Randolph W. Gerrish, Jr., and Eber K. Halteman (Nuclear Materials and Equipment Corp., Apollo, Penna.). Trans. Am. Nucl. Soc., 7: 407-8(Nov. 1964).

2343 DIFFUSION OF KRYPTON-85 IN MULTICOMPONENT MIXTURES OF KRYPTON WITH HELIUM, NEON, ARGON AND XENON. H. Watts (South Australian Inst. of Tech., Adelaide). Trans. Faraday Soc., 60: 1745-51(Oct. 1964).

The diffusion coefficient of trace amounts of krypton-85 has been measured in mixtures of krypton with helium, neon, argon, and xenon. Binary mixtures were studied over the complete composition range, and three, four, and five-component mixtures at selected compositions. The effective diffusion coefficient is given in terms of binary diffusion coefficients and the composition of the mixture. Two diffusion cells were used, and statistical analysis of the results shows there is a significant difference between the results of similar experiments performed on the two cells. (auth)

2344 EXCHANGE KINETICS OF CHLORINE WITH SODIUM CHLORIDE. A MECHANISTIC INTERPRETATION INVOLVING TRAPPED HOLES. R. J. Adams and L. G. Harrison (Univ. of British Columbia, Vancouver). Trans. Faraday Soc., 60: 1792-1802(Oct. 1964).

Kinetic studies of ^{36}Cl exchange between chlorine gas and vacuum-sublimed sodium chloride have indicated two unusual rate laws. Samples pretreated with x rays or with fluorine (to produce electronic defects) show second-order kinetics in exchange, while for untreated samples, detailed information has been obtained on "power law" kinetics. Detailed mechanisms are proposed, in which trapped-hole defects are postulated as important intermediates. The reaction schemes require both "atomic" and "molecular" defects, i.e., holes trapped singly and in pairs, and it is also required that neutral vacancy pairs should be mobile at room temperature. (auth)

2345 INFLUENCE OF STRONGLY CHEMISORBED GASES ON THE RATES OF THE PARA-HYDROGEN CONVERSION AND THE H_2-D_2 EXCHANGE OVER NICKEL AND COPPER + NICKEL ALLOY CATALYSTS. W. Keith Hall, F. E. Lutinski, and J. A. Hassell (Mellon Inst., Pittsburgh). Trans. Faraday Soc., 60: 1823-32(Oct. 1964).

When a nickel catalyst was cooled in hydrogen from 350°C to a sub-zero reaction temperature, its activity for para-ortho hydrogen conversion of H_2-D_2 exchange was considerably less than when it was outgassed at the elevated temperature and cooled in helium. The effect was reversed with Cu–Ni alloys; these were promoted by the hydrogen treatment. Both Ni and Cu–Ni alloy catalysts, when contacted briefly with C_2H_4 at sub-zero temperatures, chemisorbed a large fraction of a monolayer in a form which could not be removed with hydrogen at the same temperature. Such surfaces were more active for conversion and exchange than the corresponding clean surfaces. The rates of H_2-D_2 exchange were always somewhat slower than the $p-H_2$ conversion under comparable conditions; this was attributable to a slightly higher activation energy for the former reaction. (auth)

2346 ON THE PREPARATION AND PROPERTIES OF THE DICARBIDES OF YTTRIUM, LANTHANUM, CERIUM AND PRASEODYMIUM. T. Y. Kosolapova and G. N. Makarenko (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, USSR). Ukr. Khim. Zh., 30: 784-7(1964). (In Russian)

Preparation of Sc, Y, La, Ce, and Pr dicarbides by carbon reduction of oxides in a vacuum at 1800 to 1900°C is described. The Sc–C system did not form dicarbide. Manometric, chemical, and x-ray analyses of the intermediate products showed that only higher metal oxides reacted with dicarbides. Density, melting point, electric conductivity, and thermoelectromotive forces of the dicarbides were studied. (R.V.J.)

2347 MAGNETIC BEHAVIOR OF HEXAHALOGENO-COMPLEXES OF TETRAVALENT TECHNETIUM. K. Schwochau (Kernforschungsanlage, Julich, Ger.), A. Knappwost, E. Burkard, and T. S. B. Narssa Raju. Z. Naturforsch., 19a: 1128(Sept. 1964). (In German)

Potassium salts of the technetium hexahalide were prepared and their magnetic properties compared with corresponding rhenium complexes. Values were determined for molecular susceptibility corrections, Weiss constants, and magnetic moments. (M.C.G.)

2348 DIFFUSION OF Ca-45 IN CaF_2. Hj. Matzke and R. Lindner (CCR-EURATOM, Ispra, Italy). Z. Naturforsch., 19a: 1178-80(Oct. 1964). (In German)

The diffusion of ^{45}Ca in CaF_2 single crystals was measured by three methods in the temperature region between 800 and 1250°C. Results obtained gave $D = 130 \exp(-86500/RT)$ cm^2 sec^{-1}. Comparisons were made between diffusion processes in the "model substances," CaF_2 and KCl, among others, and those in ceramic fuel materials UO_2 and UC. (auth)

2349 ELECTRONIC INTERACTION IN ADSORPTION AND OCCLUSION OF HYDROGEN AND DEUTERIUM BY THIN ULTRAHIGH VACUUM-EVAPORATED PALLADIUM FILMS. R. Suhrmann, G. Schumicki, and G. Wedler (Technische Hochschule, Hanover). Z. Naturforsch., 19a: 1208-16(Oct. 1964). (In German)

Thin palladium films deposited in an ultrahigh vacuum were loaded at 295, 195, 90, and 77°K with measured amounts n of hydrogen or deuterium and the changes caused by this in electric resistance R as well as the photoelectric sensitivity I/I_0 of the film surface were studied. At all temperatures I/I_0 diminished very strongly at the beginning; it formed at first an externally negative adsorption layer. R increased at the same time. Still for the formation of a monatomic adsorption layer a second process, which allowed the resistance to decrease, produced the excess weight. Since the I/I_0 was not influenced by this, the gas for this second process penetrated the film. It can be desorbed in part at 295°K by pumping out under resistance increases. At 195, 90, and 77°K, under the selected pressures ($p < 10^{-1}$ torr), when the surface is filled,

in a third process essentially greater amounts of gas are taken up in the palladium volume. In this case R increased with the absorbed gas amounts up to 90% of the initial resistance. I/I_0 decreased only a little. In the absorption of deuterium the resistance increase was greater than for the absorption of hydrogen. At 195°K the originating β phase decreases when the gas pressure was lowered under 10^{-4} torr; the negative adsorption layer was not desorbed. At 90 and 77°K the β phase was stable at pressures below 10^{-7} torr. The resistance increase ended at the atomic ratios H/PD or D/Pd = 1, the β phase accordingly was completely formed. (tr-auth)

2350 EFFECTS OF HEAVY WATER ON PROTON RELAXATION TIMES OF AQUEOUS SOLUTIONS OF MANGANESE IONS. H. Sprinz (Universität, Leipzig). Z. Naturforsch., 19a: 1243-4(Oct. 1964). (In German)

Proton relaxation times for manganese ions in aqueous solutions of light and heavy water were investigated. The average lifetime of a proton in the hydrate hull was calculated. Measurements were carried out on a spin-echo spectrometer at 16 MHz for various temperatures. Results are presented in graphs of time vs D_2O content of the solution for transversal and longitudinal relaxation time. The transversal relaxation time showed no dependence on D_2O content and the longitudinal relaxation time decreased very slightly with increasing D_2O content. (M.C.G.)

2351 RECIPROCAL EXCHANGE OF CHEMISORBED DEUTERIUM AND HYDROGEN IN ULTRAHIGH-VACUUM-DEPOSITED PALLADIUM FILMS. R. Suhrmann, G. Schumicki, and G. Wedler (Technische Hochschule, Hanover). Z. Physik. Chem. (Frankfurt), 42: 187-200(Aug. 1964). (In German)

On thin palladium films evaporated in an ultrahigh vacuum, deuterium was adsorbed in measured amounts and jointly exchanged with hydrogen and conversely. The number of adsorbed, the exchanged, and the unexchanged molecules of both isotopes were measured. At the same time the dependence of the electric resistance of the film on the coating was studied. From the changes in resistance it was found whether the irreversibly adsorbed exchanging isotopes are on the film surface as negatively polarized atoms or inside the film. The experiments showed that at 295 and 77°K only the externally adsorbed $D^{(-)}$ or $H^{(-)}$ atoms are exchanged. (tr-auth)

2352 ADSORPTION OF VARIOUS GASES ON URANIUM TRIOXIDE. V. G. Vlasov, V. M. Zhukovskii, A. G. Lebedev, and V. N. Shalaginov. Zh. Prikl. Khim., 37: 2170-5(Oct. 1964). (In Russian)

Studies of the adsorption of hydrogen, carbon monoxide, ammonia, nitrogen, carbonic acid, and water vapor on UO_3 at elevated temperatures revealed a certain correlation between gas adsorption and kinetics of UO_3 reduction. (R.V.J.)

2353 DISSOCIATION OF γ-UO_3. A. R. Beketov and V. G. Vlasov. Zh. Prikl. Khim., 37: 2175-9(Oct. 1964). (In Russian)

Kinetics of orthorhombic γ-UO_3 dissociation at 600 to 675°C indicated an autocatalytic character for the process. Kinetic and x-ray analysis revealed a U_3O_{8+x} phase. Chemical reactions and electron mechanisms in the process were investigated. (R.V.J.)

2354 INTERACTION BETWEEN GRAPHITE AND VARIOUS CHEMICALLY ACTIVE GASES AT HIGH TEMPERATURES. L. N. Khitrin and E. S. Golovina (Krzhyzhanovski Energy Inst., Moscow). p.485-96 of "High Temperature Technology." Washington, D. C., Butterworths, 1964.

Principles of the reaction of gases with a solid body at high temperatures are outlined, in terms of which experimental observations on the reaction of graphite with oxygen, carbon dioxide, and water vapor at temperatures to 3000°K, using spherical bodies, are discussed. (D.C.W.)

2355 SOLS OF ZIRCONIA AND HAFNIA WITH ACTINIDE OXIDES. Frederick T. Fitch and Jean G. Smith (to W. R. Grace and Co.). U. S. Patent 3,150,100. Sept. 22, 1964. Filed Feb. 27, 1962.

Stable sols of particles composed of actinide metal oxides, and zirconia or hafnia were prepared. This material may be used in the preparation of reactor fuel elements, which resist oxidation. Active sols of the component oxides or non-oxidizing soluble salt solutions of the components are mixed and autoclaved. Autoclaving is carried out in a nitrogen atmosphere to inhibit oxidation of quadrivalent uranium. (M.C.G.)

2356 NEUTRON ABSORBING ASPHALTIC COMPOSITION. Robert O. Boykin, Sr. and Philip S. Osborne (to Osborne Associates). U. S. Patent 3,152,093. Oct. 6, 1964. Filed Feb. 9, 1959.

A method was developed for preparing an asphalt containing large quantities of boron homogeneously dispersed in it so that it can effectively absorb thermal neutrons. The asphalt may be used as a shielding, in the formation of radiation-absorbing barriers, moderators, control elements, and whenever neutron-attenuation properties are desired. The asphalt is heated to fluidity, boric acid added progressively to the fluid asphalt, and the heating continued to 210°C and until the evolution of gases and vapors has substantially terminated. As a result elemental boron in the form of boric oxide in homogeneously dispersed form is formed in situ in the mixture in concentrations between 1 and 25 wt %. (M.C.G.)

2357 APPARATUS FOR TREATMENT OF MOLTEN MATERIALS. Paul R. Josephson and Lawrence E. Burkhart (to U. S. Atomic Energy Commission). U. S. Patent 3,156,534. Nov. 10, 1964.

A vertical column for reacting two molten materials is described. The column has hollow distributor elements that are attached to an axial rotatable shaft with a nonperforated guide funnel under each element having one opening only (in the bottom around the shaft) and being attached to the inside of the column, while the elements are spaced from the column. The elements have gradually diminishing cross sections towards both the upper and the lower ends and have orifices peripherally arranged at a location of greater diameter than those of the two ends. (AEC)

Organic Chemistry

2358 (EUR-1647.e) THE PYROLYTIC DECOMPOSITION OF TERPHENYLS. G. Juppe, A. Alvarenga, and H. Hannaert (European Atomic Energy Community. Joint Nuclear Research Center, Ispra, Italy). 1964. 33p. (CONF-14-44). Dep.(mn).

From American Chemical Society 144th National Meeting, Los Angeles, Mar. 1963.

The thermal decomposition of o-, m-, p-terphenyl, and preirradiated OM2 was studied and the kinetic data obtained interpreted. A reaction mechanism is devised. (auth)

2359 (WADD-TR-61-72(Vol.X Suppl.)) RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. SUPPLEMENT TO VOLUME X. THERMAL REACTIVITY OF AROMATIC HYDROCARBONS. T. Edstrom and I. C. Lewis (National Carbon Co. Research Lab., Parma, Ohio). July 1963. Contract AF33(616)-6915. 71p. (AD-606973). $3.00(OTS).

A survey of the thermal reactivity of 84 aromatic hydrocarbons was given in WADD 61-72, Volume X. The extension of this study to 26 new aromatic hydrocarbons, 25 heterocyclic compounds, 76 substituted aromatics, and 14 binary mixtures of aromatic compounds is reported. Differential thermal analysis was employed to delineate the thermal behavior during pyrolysis to 750°C in Ar. Emphasis was placed on the role of heteroatoms and the effects of ring substituents on the thermal reactivity of aromatic hydrocarbon precursors to carbon and graphite. (auth)

2360 THE PREPARATION OF CIS- AND TRANS-4-H^3-L-PROLINES AND THEIR USE IN STUDYING THE

MECHANISM OF ENZYMATIC HYDROXYLATION IN CHICK EMBRYOS. Y. Fujita, A. Gottlieb, B. Peterkofsky, S. Udenfriend, and B. Witkop (National Institutes of Health, Bethesda, Md.). J. Am. Chem. Soc., 86: 4709-16(Nov. 5, 1964).

While iodide exchange reactions did not permit the preparation of sterically homogeneous cis- and trans-4-iodoproline derivatives as starting materials for subsequent hydrogenolysis experiments, pure cis-4-$H^2(H^3)$-(XI, XIV) and trans-4-$H^2(H^3)$-L-proline derivatives (XXI, XXIV) were prepared by S 2 displacements on the tetra-hydropyranyl ethers of trans- and cis-4-tosyloxy-N-tosyl-L-prolinols, (X, XX) followed by cleavage of the ethers, oxidation of the N-tosylprolinols (XII, XXII) to the N-tosylprolines (XIII, XXIII), and detosylation with hydrogen bromide in acetic acid. The steric homogeneity of cis- and trans-4-$H^2(H^3)$-N-tosyl-L-prolinols (XI, XXI) was ascertained by NMR spectrometry and by enzymatic methods. Enzymatic hydroxylation in vivo with chick embryos demonstrated 94% retention of tritum in cis-4-H^3-L-proline (XIV → XV) and 98% loss of tritium in trans-4-H^3-L-proline (XXIV → XXV). The hydroxylating enzyme system converts bound proline to hydroxyproline in a front-side displacement with complete retention of configuration at C-4 comparable to other enzymes which directly use molecular oxygen in the formation of the hydroxyl function. The tritium studies in conjunction with the ^{18}O studies confirmed that enzymatic conversion to collagen-bound hydroxyproline does not proceed via 3,4-dehydro-L-proline or 4-keto-L-proline as intermediates. (auth)

2361 RETICULINE AS THE BENZYLTETRAHYDROISOQUINOLINE PRECURSOR OF THEBAINE IN BIOSYNTHESIS WITH CARBON-14 DIOXIDE. Robert O. Martin, Mitchum E. Warren, Jr., and Henry Rapoport (Univ. of California, Berkeley). J. Am. Chem. Soc., 86: 4726-7 (Nov. 5, 1964).

Evidence derived from short exposures to $^{14}CO_2$ of both seedlings and budding plants of P. somniferum L. is presented that establishes beyond question the role of reticuline as the true biosynthetic benzyltetrahydroisoquinoline precursor of the hydrophenanthrene alkaloids. Reticuline as a true precursor of thebaine is presented with specific activity equal to or greater than that of thebaine after short-term exposure of plants to $^{14}CO_2$. Further support for the view that all the carbons of reticuline are incorporated into thebaine is given by the fact that the fraction of activity in the O- and N-methyl groups is substantially the same for thebaine (20%) and reticuline (17%) from a 5-day seedling experiment. (P.C.H.)

2362 THE HYDRATION OF STYRENES. W. M. Schubert, Bo Lamm, and James R. Keeffe (Univ. of Washington, Seattle). J. Am. Chem. Soc., 86: 4727-9(Nov. 5, 1964).

Evidence consistent with the rate-determining step in the hydration of styrenes being a proton transfer to styrene to form a carbonium ion is reported. Rate-determining rearrangement of an unencumbered π-complex between olefin and a proton is excluded. Values of the first-order rate constant for hydration, k_{obsd}, and of (Sty)/(ROH) at equilibrium were determined spectrophotometrically in 5-7 M perchloric acid (covering about a 15% range of acid strength) for styrene and four para-substituted styrenes. An appreciable positive solvent isotope effect was observed in the hydration of all the styrenes studied. (P.C.H.)

2363 RELATIONSHIP BETWEEN DEGREE OF IODINATION OF INSULIN AND ITS BIOLOGICAL, ELECTROPHORETIC, AND IMMUNOCHEMICAL PROPERTIES. Joseph L. Izzo, Angela Roncone, Mary Jane Izzo, and William F. Bale (Univ. of Rochester, N. Y.). J. Biol. Chem., 239: 3749-54(Nov. 1964).

The biological, electrophoretic, and immunochemical properties of a series of iodoinsulins with average incorporations of total (nonradioactive plus radioactive) iodine ranging from 0.61 to 11.1 atoms per molecule of insulin (mol. wt. 6000) were compared. For tracer purposes each preparation contained from 0.1 to 7.0 mc of ^{131}I per mg of insulin. The iodoinsulins were prepared by a chemical exchange technique with iodine monochloride, which permits precise control of the number of iodine atoms that are coupled to insulin by stable covalent bonds. Average incorporation of 1 atom or less of total iodine per molecule of insulin resulted in little or no loss of hormonal activity as measured by the mouse convulsion technique, by glucose uptake of the isolated rat diaphragm, or by $^{14}CO_2$ production by the isolated rat epididymal fat pad. However, average incorporations of more than 1 atom of iodine per molecule of insulin resulted in progressive loss of biological activity, which was inversely related to the number of iodine atoms attached to insulin. Average incorporation of total iodine up to 11.1 atoms per molecule of insulin did not markedly impair the characteristic ability of insulin to bind to paper or to remain at the site of application when an electrical voltage is applied. Nor did increasing iodination greatly alter the characteristic ability of insulin to migrate in the region of serum albumin when the paper is presaturated with native insulin prior to electrophoresis. Average incorporation of total iodine up to 6 atoms per molecule of insulin had no significant effect on the capacity of iodoinsulin to bind with specific antibodies to insulin which were present in graded dilutions of pooled serum from guinea pigs challenged with insulin, as measured by radiochromatoelectrophoresis. These results indicate that the biological, electrophoretic, and immunological properties of insulin are affected differently by iodination. The results also indicate that these differential effects should be considered in the use of radioiodinated insulin for physiological studies or immunoassay purposes. (auth)

2364 BIOSYNTHESIS OF UREA. X. STEREOSPECIFICITY OF THE ARGININOSUCCINASE REACTION. Henry D. Hoberman, Evelyn A. Havir, Olga Rochovansky, and S. Ratner (Albert Einstein Coll. of Medicine, New York; Yeshiva Univ., New York; and Public Health Research Inst. of The City of New York, Inc., New York). J. Biol. Chem., 239: 3818-20(Nov. 1964).

Aspartate-2,3-^3H was prepared with stereospecific label by the action of aspartase on fumarate-2,2′-^3H. Argininosuccinate-^3H formed from this aspartate by the action of argininosuccinate synthetase was then cleaved to arginine and fumarate by argininosuccinase. The fumarate isolated from the reaction mixture contained all of the tritium initially present in the aspartate. Since inversion of configuration, either during synthesis or during cleavage, is very unlikely, the present results show that argininosuccinase brings about a trans removal of arginine from its substrate. (auth)

2365 PREPARATION OF BILIRUBIN-C^{14}. L. Evan Custer, Tohru Abei, Benjamin R. Chipman, and Frank L. Iber (Johns Hopkins Hospital, Baltimore). J. Lab. Clin. Med., 64: 820-7(Nov. 1964).

Carbon-14-labeled bilirubin was prepared in a new way. Erythrocytes taken from ducks treated with acetylphenylhydrazine are incubated with glycine-2-^{14}C, glucose, and ferrous ion to prepare ^{14}C-labeled hemoglobin. In 12 hours' incubation, about 70% of the radioactivity is incorporated. The lysed erythrocytes containing labeled hemoglobin are injected intravenously into a dog prepared with a biliary fistula. Radioactive bilirubin is recovered by recrystallization from the bile. Approximately 45 mg of crystalline bilirubin are obtained from a dog in 24 hours and the specific activity of the bilirubin is approximately 2,000 disintegrations per minute per microgram bilirubin. (auth)

2366 THE TRITIATION OF DIETHYL BENZYLACETAMIDOMALONATE BY EXPOSURE TO TRITIUM GAS. Helen Krizek, Anthony J. Verbiscar, and Weldon G. Brown (Argonne Cancer Research Hospital, Chicago). J. Org. Chem., 29: 3443-5(Nov. 1964).

The tritium gas exposure technique was applied to diethyl benzylacetamidomalonate, and tritiated dl-phenylalanine was obtained by suitable degradations. Two samples of tritium-irradiated diethyl benzylacetamidomalonate were purified by methods including solution in methanol, treatment with water vapor, and washing with sodium hydroxide

to remove labile hydrogen; recrystallization; and repeated chromatography on activated alumina. An outline is given for degradation and derivatization of the purified samples. Data on the activity of fragments and derivatives of tritium-irradiated diethylbenzylacetamidomalonate are tabulated. Differences in distribution of the two samples may have resulted from traces of impurities of high specific activity. (P.C.H.)

2367 TRANSFER OF EXCITATION ENERGY IN RIGID SOLUTIONS OF ORGANIC SCINTILLATORS. Louis J. Basile (Argonne National Lab., Ill.). Trans. Faraday Soc., 60: 1702-14(Oct. 1964).

Fluorescence spectra and lifetimes have been measured for solid solutions of 1,1,4,4-tetraphenylbutadiene and p-terphenyl in polystyrene. Transfer efficiencies were obtained for the system polystyrene–1,1,4,4-tetraphenylbutadiene. The presence of residual styrene monomer is confirmed. Results indicate that residual styrene monomer participates in the energy-transfer process both as an acceptor and as a donor molecule. Agreement was obtained between the experimental results and Förster's theory of dipole-dipole energy transfer. Values for some rate constants, quantum yields, and critical transfer distances R_0 are obtained from an analysis of the data. (auth)

2368 CARBON SUBOXIDE POLYMERS. PART 2. PYROLYSIS OF THERMAL POLYMERS. A. R. Blake and A. F. Hyde (Central Electricity Generating Board, Berkeley, Gloucestershire, Eng.). Trans. Faraday Soc., 60: 1775-82(Oct. 1964).

The properties of thermal suboxide polymers before and after pyrolysis have been examined. On pyrolysis at temperatures below 350°C the polymer, which initially has an empirical formula $(C_3O_2)_n$, loses carbon dioxide, but at higher temperatures carbon monoxide is also produced. The structure of the carbonized product is dependent on the mode of decomposition. It is suggested that the low-temperature product is a result of cross-linking of carbon chains, which need not be broken during pyrolysis and that the material formed at high temperature is the result of a more fundamental rearrangement involving single carbon atoms. (auth)

2369 ISOTOPE EFFECT IN CATALYTIC FORMIC-ACID DEHYDROGENATION. George Maria Schwab and Allan M. Watson (Universität, Munich). Trans. Faraday Soc., 60: 1833-46(Oct. 1964).

The kinetic isotope effect has been measured for the decomposition of the deuterated formic acids, HCOOD, DCOOH, and DCOOD on the group 1B metals and on palladium. The magnitude of the kinetic isotope effect increases with increasing activation energy of the decomposition. This increase cannot be fully accounted for by the increase in activation energy difference with increasing activation energy, as is usually found. An entropy effect is considered to be wholly or partially responsible for the increase in the kinetic isotope effect. Although no one mechanism for the formic acid decomposition can be proposed with certainty, some possibilities can be excluded, because of their failure to predict the observed kinetic isotope effect. (auth)

Radiation Chemistry

Refer also to abstract 2677.

2370 (BNL-8537) REACTIONS AND MECHANISMS INVOLVING HOT CARBON ATOMS AND N_2-H_2, N_2-ALKANE AND N_2-ALKANE–MODERATOR SYSTEMS INCLUDING THEIR RELATIONSHIP TO OTHER SIMPLE SYSTEMS. Hans Ache and Alfred P. Wolf (Brookhaven National Lab., Upton, N. Y.). [1964]. Contract AT-30-2-GEN-16. 20p. (CONF-773-3). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Symposium on Chemical Effects Associated with Nuclear Reactions and Radioactive Transformation, Vienna, Dec. 1964.

"Hot" carbon atoms react with nitrogen to give HC ≡ N. The presumed intermediate, the cyano radical [·CN], can only be formed by a hot reaction. Relative reactivity ratios have been obtained for various substrates in reaction with "hot" carbon atoms. These are $\sigma_{CO(HOT)}/\sigma_{HCN(HOT)} \cong 9$ and $\sigma_{HCN(HOT)}/\sigma_{C_2H_2(HOT)} \cong 0.22$. A "calculated" value of $\sigma_{CO(HOT)}/\sigma_{C_2H_2(HOT)} \cong 2$ is in agreement with the experimental value of Stöcklin and Wolf. The insertion ratio for ^{11}C + primary C–H bonds versus ^{11}C + secondary C–H bonds to give acetylene $[1°C-H/2°C-H]_{C_2H_2}$ is ≅1.26. The preference for primary C–H bonds is in agreement with the structural dependence of acetylene yields. The isotope effect in the overall reaction giving acetylene is small ranging from 1.07 to 1.27 and probably related to the so-called "high temperature limit" effects. Isotopic mixing seen in doubly labeled acetylene produced by "hot" reaction on specifically labeled alkanes reflects both the intramolecular nature of the process (since 1/1 mixtures of alkane-perdeutero alkane do not show the same degree of mixing) and the large amount of excitation energy available in the reaction complex. Evidence for mechanistic structural dependence was adduced from the cyclopropane-1-H_2^3 results. (auth)

2371 (HW-SA-3066) KINETIC STUDIES OF ORGANIC RADICALS FORMED IN IRRADIATED AQUEOUS SOLUTION. R. N. Diebel and D. R. Kalkwarf (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 3, 1963. Contract AT(45-1)-1350. 14p. (CONF-157-8). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Chemical Society Northwest Regional Meeting, Bellingham, Wash., June 1963.

The possible formation of long-lived radicals in irradiated aqueous solutions is discussed. An apparatus for studying such radicals was designed in which a solution is irradiated by ^{60}Co and then rapidly transferred to an electron spin resonance spectrometer. Studies were carried out on p-nitroaniline in basic solutions to test the apparatus, and the ESR spectra show a radical with the unpaired electron on the nitrogen atom in the nitro group. The decay of this radical was studied. Studies were also made on solutions of N,N-dimethyl-p-phenylenediamine hydrochloride. (D.L.C.)

2372 (NRS-22) GAMMA IRRADIATION OF URACIL IN DE-AERATED AQUEOUS SOLUTIONS. M. N. Khattak and J. H. Green (New South Wales, Australia. Univ., Kensington). 1964. 6p. Dep.(mn).

Radiolysis of uracil in de-aerated aqueous solutions is examined. Reaction mechanisms and radiolysis products are reported. (J.R.D.)

2373 (ORNL-P-661) EFFECTS OF GAMMA RADIATION ON CATION EXCHANGE RESIN IN A FLOWING WATER SYSTEM. W. C. Yee and W. Davis, Jr. (Oak Ridge National Lab., Tenn.). [1964]. Contract W-7405-eng-26. 14p. (CONF-654-7). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

Prolonged exposure of cation exchange resin in the hydrogen form to gamma radiation and flowing water caused more drastic changes in the chemical and physical properties of the material than was reported by other investigators for resin exposed to like dosage in a static system. After a dose of 0.75×10^9 rads in a dynamic system, the rate of loss of strong-acid capacity was 20 to 25% per whr per gram of dry resin, compared with the 4% and the 10 to 20% found by others for the static system. Also, decrosslinking of more than 4% of the resin matrix accompanied this loss of capacity, compared with the more moderate de-crosslinking or even additional crosslinking reported for the static system. Gamma radiation also caused gas evolution, bead swelling, and produced a weak-acid capacity in the resin equivalent to 3 to 5% of the original strong-acid capacity. Decomposition products included soluble sulfuric, sulfonic, and oxalic acids, and insoluble bits of resin. The G(-S) value was estimated to

represent 1.0 to 1.2 atoms lost per 100 ev of energy absorbed. (auth)

2374 (PAN-527/XVII) POLAROGRAPHIC INVESTIGATION OF GAMMA-RADIATION INDUCED OXIDATION OF IRON(II) IN NEUTRAL AQUEOUS SOLUTION. Zbigniew P. Zagórski (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Mar. 1964. 37p. Dep.

Kinetic curves were obtained of concentration changes of iron(II), hydrogen ions, and hydrogen peroxide (present transiently) in gamma-irradiated aqueous solution, 0.1 M in Na_2SO_4 and pH 5 to 8.5. Low radiation yields of iron(II) have been found, indicating that H_2O_2 is the lone oxidation agent towards iron(II) in neutral solution. (auth)

2375 (UJV-1119/64) LOCALIZATION OF ENERGY IN THE RADIOLYSIS OF SOLUTIONS. PART VI. REMARKS TO THE PAPER "ENERGY PARTITION IN THE RADIOLYSIS OF AROMATIC MIXTURES." J. Bednář (Československá Akademie Věd. Ústav Jaderného Vyzkumu, Řež). [1963]. 14p. Dep.(mn).

The results of radiolysis of benzene–pyridine mixtures are in accordance with the possible role of electronic excitation spectra in the radiolysis of mixtures. In the system benzene–pyridine the proportionality of yields to electron fractions results from the iso-electronicity and similarity of the excitation spectra of both components. (auth)

2376 RADIOSENSITIVITY OF CAROTENOIDS AND PHTHALOCYANINES IN SOLID PHASE. Alessandro Checcucci, Joseph Depireux, and Jules Duchesne (Université, Liège and Institut d'Astrophysique, Cointe-Sclessin, Belg.). Compt. Rend., 259: 1669-71(Aug. 31, 1964). (In French)

The radiolytic yields (in free radicals) of vitamin A_1, retinene, β-carotene, and phthalocyanine with and without Fe^{3+} were studied after x irradiation using electron spin resonance. The results conform satisfactorily to the empirical rule relating the radiation resistance to the resonance energy of the molecular systems. The yield for the phthalocyanine was notably reduced by the Fe^{3+}. (D.C.W.)

2377 FREE RADICALS INDUCED IN THYMIDINE TRITIATED OR IRRADIATED BY X AND γ RADIATION. Marcel Lacroix and Claudine Williams-Dorlet (Universite, Liege and Institut d'Astrophysique, Cointe-Sclessin, Belg.). Compt. Rend., 259: 1771-4(Sept. 7, 1964). (In French)

The existence of two types of radicals in solid thymidine irradiated with electrons from tritium, x rays, or ^{60}Co gamma rays was established using electron paramagnetic resonance. Radiolytic yields were also determined. (D.C.W.)

2378 THE MÖSSBAUER EFFECT IN UNSYMMETRICAL ORGANIC TIN COMPOUNDS CONTAINING ELECTRON-DONOR SUBSTITUENTS. A. Yu. Aleksandrov, O. Yu. Okhlobystin, L. S. Polak, and V. S. Shpinel (Moscow State Univ.). Dokl. Akad. Nauk SSSR, 157: 934-7 (Aug. 1, 1964). (In Russian)

Quadrupole splitting of the 23.8-kev transition in ^{119}Sn was observed mainly, when the Sn atom was bound covalently with at least two different atoms and the electronegativity of the substituent group was significantly greater than the electronegativity of the Sn atom. Resonance absorption spectra of the 23.8-kev γ quanta from ^{119}Sn were investigated for organotin compounds such as the hydrides R_nSnH_{4-n} and R_4SnH, the hexa-alkyl distannanes $R_3Sn-SnR_3$, the triphenyl tin-lithium compound $(C_6H_5)_3SnLi$, and R_3SnR' compounds (where $R = C_nH_{2n+1}$, and $R' = C_6H_5$). The quadrupole splitting Δ was found to be zero for the above compounds. The introduction of an electrodonor substituent in the organic tin molecule did not lead to a noticeable change in symmetry of p-components of all four tin bonds. The shift in electric charge to the Sn atom led to symmetrization of all four hybridized tin orbits. In inorganic compounds that did not have a C–Sn bonding, the isomeric shift δ varied from 0 to 4.0 mm/sec. However, the isomeric shift δ for all the compounds was the same with $\delta = 1.45$. This value was close to the value $\delta = 1.3$ for a tetrahedral configuration of $(C_4H_9)_4Sn$. A study of the resonance absorption spectra of γ quanta gave useful information on the distribution of electron charge. (TTT)

2379 A CHANGE IN THE PHASE COMPOSITION OF GLASSY ORES ON IRRADIATION WITH γ-RAYS. S. M. Brekhovskikh, L. M. Landa, and N. I. Chubkina. Dokl. Akad. Nauk SSSR, 157: 938-9(Aug. 1, 1964). (In Russian)

Transparent mineral samples of β-eucryptite were given ^{60}Co gamma doses of 10^2, 10^3, and 10^5 R. Irradiation with a dose of 10^2 R led to an increase in the amount of β-eucryptite in the mineral. The ratio of line intensities of the unirradiated to the irradiated glassy ores was 0.8 to 0.85. With an irradiation dose of 10^3 R, the line corresponding to a distance of 3.49 Å split into two, and a peak was observed corresponding to a value of d = 3.34 Å, the most intense line in α-quartz. With a dose of 10^5 R, a maximum was observed corresponding to d = 4.25 Å, the second most intense line in α-quartz. Gamma irradiation resulted in a transformation of glass to crystallites. (TTT)

2380 THE MECHANISM OF THE RADIATION POLYMERIZATION OF ISOBUTYLENE AND STYRENE IN THE PRESENCE OF SOLIDS. A. I. Popova, A. P. Sheinker, and A. D. Abkin (Karpov Inst. of Physics and Chemistry, Moscow). Dokl. Akad. Nauk SSSR, 157: 1192-5(Aug. 11, 1964). (In Russian)

The separate and joint polymerization of isobutylene and styrene at 0 and −78°C by ^{60}Co γ radiation were investigated in the presence of finely-dispersed glass powder and zinc oxide, and in the absence of any solid. It was found that the yield of isobutylene polymer increases sharply on adding zinc oxide to the monomer not only at −78°, but also at 0°C. Zinc oxide promotes the polymerization of styrene at 0°C, but the use of fine glass powder has no effect on the rate of styrene polymerization at 0°C. Isobutylene tends to polymerize in the presence of zinc oxide at 0°C with γ-radiation, and gives a polymer with a molecular weight of ~20,000 under these conditions. This reaction is not observed in the absence of radiation at −78°C, or on replacing zinc oxide by glass powder. Copolymers of isobutylene and styrene that are enriched in the isobutylene component are obtained by γ radiation at 0°C in the presence of zinc oxide. The rate constants for the joint polymerization of isobutylene and styrene at 0° are 3.3 and 0.2 respectively, calculated on the basis of the composition of the copolymers. The rates are 0.5 and 3.7, respectively in the presence of glass powder or without any solid being present. The joint polymerization of isobutylene and styrene at 0°C takes place by an ion radical mechanism in the presence of zinc oxide and γ radiation. (TTT)

2381 A KINETIC ANALYSIS OF SHORT-CHAIN, RADIATION-INITIATED ADDITION REACTIONS. L. H. Gale and C. D. Wagner (Shell Development Co., Emeryville, Calif.). J. Am. Chem. Soc., 86: 4531-7(Nov. 5, 1964).

Kinetic expressions for product yields in short-chain, radiation-initiated free-radical addition reactions were developed in a novel way, based upon radiation yields. It is shown by using model systems involving addition of isopropyl alcohol and isopropylamine to α-olefins that effects of reaction variables on yield of 1:1 adduct and ratios of 1:1 to 1:2 adduct are as predicted. A procedure is developed for using short-chain reactions to determine transfer constants. The true kinetic chain length of a chain reaction includes a contribution from the reaction $A\cdot + AB \rightarrow AB + A\cdot$, which, of course, is ordinarily unobserved. An isotopic experiment shows that in the systems under study it is unimportant. It was concluded that the conventional chain length for such reactions is close to the true chain length. (auth)

2382 ENERGY TRANSFER IN THE FLUORESCENCE OF IODINE EXCITED BY THE SODIUM D LINES. Robert L. Brown and W. Klemperer (Harvard Univ., Cambridge, Mass.). J. Chem. Phys., 41: 3072-89(Nov. 15, 1964).

Absorption of the sodium D lines excites I_2 molecules predominantly to the vibration-rotation levels $v' = 14$, $J' = 113$; $v' = 15$, $J' = 44$ and 37; and $v' = 16$, $J' = 106$ of the $B^3\Pi_{0+u}$ electronic state. In the absence of foreign gases, approximately 75% of the excited molecules are in $v' = 15$, 10% in $v' = 14$, and 10% in $v' = 16$. Steady-state fluores-

cence from these levels and neighboring levels populated by collisions with added inert molecules was used to obtain collision cross sections for exchange of vibrational energy of excited I_2 with the translational energy of the gases He, Ne, Ar, Kr, Xe, H_2, HD, D_2, N_2, O_2, and NO. Relative emission intensities were measured photoelectrically. Vibrational transfer is highly efficient; cross sections for one quantum transfer average about ⅛ kinetic-theory cross sections taken from gas viscosities and are similar to those obtained by others for transfer from $v' = 25$. Information on multiple quanta transfer could not be obtained directly because of band overlapping. On transfer of a vibrational quantum by He, H_2, HD, and D_2, some persistence of the initial rotational state in I_2 was observed, while with the heavier gases the rotational distribution was spread. In collisions with HD no evidence was found for any resonance exchange between HD rotational energy (91 cm^{-1} for the $J = 0 \rightarrow 1$ transition) and I_2 vibrational energy (100 cm^{-1} for level separation around $v' = 15$). Quenching of the fluorescence by the above foreign gases and by I_2 itself was found to be proportional to the product of the polarizability of the inert molecules and the reciprocal of the relative velocity of the colliding particles. Absolute radiative transition probabilities for a number of individual rotational lines in the I_2 visible spectrum were also determined. (auth)

2383 ULTRAVIOLET-INDUCED ISOTOPE EXCHANGES IN GASEOUS MIXTURES OF HCl AND D_2 AND OF DCl AND H_2. A. E. de Vries and F. S. Klein (Weizmann Inst. of Science, Rehovoth, Israel). J. Chem. Phys., 41: 3428-35(Dec. 1, 1964).

Mixtures of HCl and D_2 and of DCl and H_2 were irradiated with an ultraviolet mercury resonance lamp and analyzed mass spectrometrically for the different isotopic species of hydrogen. It was found that at room temperature the reaction $H + DCl \rightarrow HD + Cl$ is slower than the exchange reaction $H + DCl \rightarrow D + HCl$. This is to be expected from a consideration of activation energies, but it is in apparent contradiction to earlier results obtained by others. The reaction between hydrogen atoms and hydrogen molecules was found to be much faster at this temperature than is usually estimated. (auth)

2384 OPTICAL PROPERTIES OF RADIOLYTIC FRAGMENTS IN PURE AND SILVER-DOPED $NaNO_3$ AND KNO_3. Joseph Cunningham (Illinois Inst. of Tech., Chicago and Argonne National Lab., Ill.). J. Chem. Phys., 41: 3522-8(Dec. 1, 1964).

Absorption bands attributed to nitrogen-oxygen radiolytic fragments in pure $NaNO_3$ and KNO_3, grew much more slowly when crystals containing 0.4 ion % of Ag^+ were irradiated with x or γ rays at 77°K. Competition between Ag^+ and other species for available low-energy electrons was indicated in the silver-doped crystals by growth of an absorption band attributable to silver atoms. Radio-induced absorbance above 300 mμ in pure $NaNO_3$ and KNO_3, and its response to optical bleaching, is shown to be explicable in terms of Gaussian absorption bands arising from three radiation-produced electron-excess centers. Observed results, including correlations between the centers and their resistance to annealing at 300°K, can be accounted for by proposing NO_2^{3-}, NO_3^{2-}, and $N_2O_3^{2-}$ as the identities of the electron-excess species. (auth)

2385 ELECTRON SPIN RESONANCE OF TRAPPED ELECTRONS IN IRRADIATED SODIUM NITROPRUSSIDE. J. Danon, R. P. A. Muniz, and H. Panepucci (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). J. Chem. Phys., 41: 3651-2(Dec. 1, 1964).

Powdered sodium nitroprusside irradiated with 2-Mev electrons from a linear accelerator becomes strongly paramagnetic. The radio-induced defects were investigated by ESR. The spectrum observed exhibits an intense line at $g \sim 2$ with a six-line structure, not well resolved. Solution of the irradiated solid in dimethylformamide shows a well-resolved resonance triplet with $\langle g \rangle = 2.025$ for the central line and an hyperfine splitting of 14.7 G. The spectrum arises from the interaction of an unpaired electron with the ^{14}N nucleus of NO and coincides in every respect with the well-known spectum of $|Fe1(CN)_5NO|^{3-}$ obtained by electrolytic reduction of the nitroprusside ion. The results led to the conclusion that, in consequence of the irradiation, a secondary electron is trapped in an antibonding orbital of the diamagnetic $|Fe\text{-}11(CN)_5NO|^{2-}$, forming the paramagnetic $|Fe1(CN)_5NO|^{3-}$, with the $3d^7$ spin-paired configuration for the central ion. (P.C.H.)

2386 OPTICAL BLEACHING OF F CENTER IN KCl: Ag^+ CRYSTALS. Masakazu Ishiguro, Takeshi Okuno, and Toshikazu Shimada (Osaka Univ.). J. Phys. Soc. Japan, 19: 1746(Sept. 1964).

Observations on the optical bleaching of F centers in pure and silver-doped KCl crystals are summarized, and interpretation of the effect of Ag^+ ion on the optical bleaching is presented. (D.C.W.)

2387 THE EFFECTS OF γ-RAYS ON POLYMERS IN AQUEOUS SOLUTION. II. γ-RAY IRRADIATION OF AN AQUEOUS SOLUTION OF POLYVINYL ALCOHOL IN ABSENCE OF OXYGEN. Akira Matsumoto (Tokyo Metropolitan Univ.). Kobunshi Kagaku, 20: 275-81(1963). (In Japanese)

The viscosity of the solutions of polyvinyl alcohol (PVA) was increased by ^{60}Co γ irradiation. The critical concentration for gel formation was 0.17 g/100 ml or less. The critical irradiation dose for gelation decreased linearly with the PVA concentration, but no minimum value in radiation dose was observed. At the critical concentration all PVA molecules may be in contact with each other. Based on the critical concentration, the radius of PVA molecule of degree of polymerization 1000 was calculated 200 Å or more in aqueous solution. In presence of some organic compounds, such as ethanol, ethyl amine, dioxane, and phenol, gel formation was inhibited and scission of main chain was observed. In the PVA molecule irradiated in presence of ethyl amine, the fragments of ethyl amine combined were detected by the dinitrofluorobenzene addition reaction. Depression of viscosity was observed when aqueous PVA solution was irradiated at a concentration below 0.17 g/100 ml, but in this phenomenon main-chain scission is not responsible. Several salts, e.g., KCl, $Al(NO_3)_3$, $CuSO_4$, and acid, were observed to act as salting out agents for PVA in solution, but several basic salts such as Na_2CO_3, Na_2HPO_4, and NaOH did not. The formation of a spherical microgel was confirmed by light-scattering measurements. The solutions irradiated with a high dose became yellowish in color in alkaline solution; two weak absorption bands were observed, at 240 and 290 mμ, respectively. These may be attributed to the absorptions of $-(CH=CH)-\dot{C}=C$ and $-(CH=CH)_2-\dot{C}=O$. (BBB)

2388 LOW-TEMPERATURE RECOMBINATION LUMINESCENCE IN ALKALI HALIDE CRYSTALS. M. N. Kabler (Naval Research Lab., Washington, D. C.). Phys. Rev., 136: A1296-1302(Nov. 30, 1964).

Luminescence observed upon low-temperature x-ray excitation of alkali-halide crystals has been identified as resulting from radiative electron-hole recombination in the perfect lattice. In KCl the emission spectrum is a single band, while in KBr, KI, and NaCl there are two bands. In crystals containing self-trapped holes, optical excitation of electron-excess defects such as F centers causes transfer of electrons to holes with emission of recombination luminescence identical to that excited directly by x-ray irradiation. If the holes have been preferentially oriented, the optically excited luminescence from KCl and KBr exhibits partial polarization characteristic of the transitions involved. The origin of the recombination luminescence is revealed through these polarization properties, together with results on optical excitation and bleaching spectra, temperature dependence, excitation efficiency, and impurity independence. The relevance of this work to the process of electron tunneling from excited F centers is discussed from an elementary point of view. The bleaching of F and F' centers through the absorption of recombination luminescence is shown to be a potentially important

factor in determining the growth rates of the various centers during high-energy irradiation. (auth)

2389 NONDIPOLAR INTERACTION BETWEEN NEAREST-NEIGHBOR NEODYMIUM IONS IN THE ETHYL SULFATE. J. M. Baker (Univ. of California, Berkeley). Phys. Rev., 136: A1341-7(Nov. 30, 1964).

Measurements made on the EPR spectrum of a pair of interacting nearest-neighbor neodymium ions in lanthanum ethyl sulfate show that the interaction is predominantly dipolar, but that there is an additional nondipolar term. A semiquantitative discussion is given of the possible origins of this nondipolar contribution, including superexchange, electric quadrupole-quadrupole, and virtual-phonon exchange interactions. (auth)

2390 UNIMOLECULAR DISSOCIATION OF INTERMEDIATE ION-MOLECULE COMPLEXES IN THE RADIOLYSIS OF ETHYLENE. G. G. Meisels (Union Carbide Corp., Tuxedo, N. Y.). Trans. Am. Nucl. Soc., 7: 308 (Nov. 1964).

2391 THE RADIATION-INDUCED INTERCONVERSION OF ACETONE-CARBON-14 AND 2-PROPANOL-CARBON-14. John G. Burr and F. C. Goodspeed (North American Aviation, Thousand Oaks, Calif.). Trans. Am. Nucl. Soc., 7: 308-9(Nov. 1964).

2392 RADIOLYSIS OF ISOPRENOIDS IV: CARBON-14 LABELLED 2-METHYLBUTENE-2. J. F. Pestaner and R. Yahiku (Stanford Research Inst., Menlo Park, Calif.). Trans. Am. Nucl. Soc., 7: 309(Nov. 1964).

2393 THE RADIATION INDUCED DECOMPOSITION OF MILLIMOLAR CONCENTRATIONS OF HYDROGEN PEROXIDE IN 'PURE WATER.' William R. Balkwell and Susan B. Oldham (Stanford Research Inst., Menlo Park, Calif.). Trans. Am. Nucl. Soc., 7: 309-10(Nov. 1964).

2394 IMPLICATIONS FOR RADIATION CHEMISTRY OF THE LARGE ELECTRON PULSES OBSERVED IN HYDROCARBONS. S. I. Taimuty and A. H. Samuel (Stanford Research Inst., Menlo Park, Calif.). Trans. Am. Nucl. Soc., 7: 310-11(Nov. 1964).

2395 RECENT OBSERVATIONS ON THE FIXATION OF NITROGEN BY IRRADIATION OF A NITROGEN–OXYGEN GAS MIXTURE. J. W. Sutherland, J. Pruzansky, and M. Steinberg (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 311(Nov. 1964).

2396 THE RADIATION-INITIATED SOLID-STATE POLYMERIZATION OF TRIOXANE. H. Rao and D. S. Ballantine (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 312(Nov. 1964).

2397 THE ROLE OF FREE RADICALS IN SOLID-STATE POLYMERIZATION OF ACRYLAMIDE. G. Adler and J. H. Petropoulos (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 312-13(Nov. 1964).

2398 HIGH-PRESSURE ETHYLENE POLYMERIZATION REACTIONS WITH COBALT-60 GAMMA RADIATION. Peter Colombo, L. E. Kukacka, J. Fontana, R. N. Chapman, and M. Steinberg (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 313(Nov. 1964).

2399 THE RADIATION-INDUCED POLYMERIZATION OF SEVERAL VINYL MONOMERS. D. J. Metz (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 313-14(Nov. 1964).

2400 THE HETEROGENEOUS IRRADIATION CATALYSIS OF CARBON DIOXIDE. R. N. Dietz, Ju Chin Chu, and M. Steinberg (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 314-15(Nov. 1964).

2401 SELECTION OF A RADIATION SOURCE FOR A CHEMICAL PROCESS. C. D. Wagner (Shell Development Co., Emeryville, Calif.). Trans. Am. Nucl. Soc., 7: 317 (Nov. 1964).

2402 CHEMICAL EFFECTS OF X-RAYS ON INORGANIC FLUORIDES. I. APPARATUS, TECHNIQUES, AND PRELIMINARY RESULTS. W. T. Rainey, Jr., T. H. Mauney, D. N. Hess, and H. F. McDuffie (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 440-1(Nov. 1964).

2403 THERMAL ANNEALING OF NEUTRON IRRADIATED ANTIMONY COMPOUNDS. J. F. Facetti, E. Trabal, and S. Torres (Puerto Rico Nuclear Center, Mayaguez). Trans. Am. Nucl. Soc., 7: 441(Nov. 1964).

2404 RELATIVE ROLES OF PYROLYSIS AND RADIOLYSIS IN THE DEGRADATION OF TERPHENYLS. Edward A. Mason, Jean-Francois Terrien, and Tom H. Timmins (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 7: 441-2(Nov. 1964).

2405 ADDITIVITY OF SIMULTANEOUS RADIATION EFFECTS. Joseph Silverman (Univ. of Maryland, College Park). Trans. Am. Nucl. Soc., 7: 442-3(Nov. 1964).

2406 THE RADIOLYSIS OF AROMATIC COMPOUNDS: I. TOLUENE. J. Weiss and C. H. Collins (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 443-4(Nov. 1964).

2407 RADIATION STABILITY OF SOME LIQUID FLUOROCARBON SYSTEMS AT ELEVATED TEMPERATURES. F. W. Bloch and D. R. MacKenzie (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 444-5(Nov. 1964).

2408 RADIOLYSIS AND PROPERTIES OF SANTOWAX WR. Edward A. Mason, William N. Bley, and Arthur H. Swan (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 7: 445-6(Nov. 1964).

2409 EFFECTS OF GAMMA RADIATION ON CATION EXCHANGE RESIN UNDER SIMULATED PROCESSING CONDITIONS. W. C. Yee and W. David, Jr. (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 446(Nov. 1964). (ORNL-P-463)

2410 IN PILE COOLANT IRRADIATIONS FOR ORGEL. H. Hannaert and M. van Der Venne (Euratom, Ispra, Italy). Trans. Am. Nucl. Soc., 7: 524(Nov. 1964).

2411 DESIGN AND ECONOMIC STUDY OF A GAS-PHASE CHEMONUCLEAR OZONE PROCESS. M. Beller, D. Goellner, and M. Steinberg (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 532(Nov. 1964).

2412 POLARIZATION OF THE VISIBLE ABSORPTION SPECTRUM OF NO_2. N. M. Atherton, R. N. Dixon, and G. H. Kirby (Univ. of Sheffield, Eng.). Trans. Faraday Soc., 60: 1688-93(Oct. 1964).

The e.s.r. spectrum and the visible absorption of NO_2 have been observed in γ-irradiated single crystals of $NaNO_2$ at room temperature. The orientation of NO_2, as deduced from the e.s.r. spectrum, is in the crystal ac plane. The polarization of the 4000 Å absorption band of NO_2 is parallel to the γ-molecular axis. The possible excited states of NO_2 are discussed. (auth)

2413 UV-INDUCED RADIOPHOTOLUMINESCENCE IN SILVER-ACTIVATED METAPHOSPHATE GLASSES. K. Becker (Kernforschungsanlage, Jülich, Ger.). Z. Naturforsch., 19a: 1233-4(Oct. 1964). (In German)

It was found that short-wave ultraviolet radiation is sufficient to form new permanent fluorescence centers in silver-activated metaphosphate glass variations of relative fluorescence intensity with time were determined and graphed. (M.C.G.)

2414 RADIATION OXIDATION OF N,N-DIETHYL-p-PHENYLENEDIAMINE. Hans Grueter (Universität, Munster, Ger.). Z. Naturforsch., 19b: 777-80(Sept. 1964). (In German)

N,N-Diethyl-p-phenylenediamine was oxidized in aqueous solutions by x-ray irradiation in several decomposition steps. One after another semiquinone diimine, and quinone monoimine. Measurements of the light extinction in the absorption maxima of the individual products gave a picture

of the reaction course during irradiation. At pH 7 and O_2 saturation of the solvent, the concentration curves of the semiquinone and the quinone diimine agreed essentially with the course for chemical oxidation. The quinone monoimine, end product of chemical oxidation at pH 7.5, was further decomposed by the action of radiation. In the alkaline region p-benzoquinone was detected as a yield product. In general an increasing pH value increased the decomposition rate of the radioinduced reaction. In O_2-free solutions the N,N-diethyl-p-phenylenediamine at pH 7 was oxidized only to the monoimine. At pH3 and pH5 the radiation oxidized only the already present semiquinone without attacking the reduced form of the p-phenylenediamine derivative. (tr-auth)

2415 PHOTOCHEMISTRY OF RIBONUCLEIC ACIDS. I. PHOTOPRODUCTS OF URIDYLIC ACID AND CYTIDYLIC ACID AND THEIR DETECTION IN UV-IRRADIATED RIBONUCLEIC ACIDS. Heniz Schuster (Max-Planck-Institut für Virusforschung, Tubingen, Ger.). Z. Naturforsch., 19b: 815-30(Sept. 1964). (In German)

Irradiation of uridylic acid (Up) in buffer (at 254 or 280 mμ) yielded the hydrated molecule (UpH_2O), which on subsequent alkaline treatment decomposed to Up (65%) and a new compound A (35%) with the pyrimidine-ring opened. Irradiation in ice (254 mμ) led to the formation of the uridylic acid dimer (Up/Up), which on re-irradiation reverted to Up (230 mμ, in neutral solution) or compound A, (via Up and UpH_2O) (254 mμ, in alkaline solution). Similarly the hydrated cytidylic acid (CpH_2O) was formed by irradiation of cytidylic acid (Cp) in buffer (254 mμ). In a subsequent dark reaction most of the CpH_2O molecules reverted to Cp a minor part being deaminated to UpH_2O. Alkaline treatment of an irradiated Cp solution yielded Cp, Up, and compound A, the latter two arising by decomposition of UpH_2O. Neither Cp nor Up dimers were found after irradiation of Cp in ice (254 mμ). All the photoproducts of Up and Cp, in which the pyrimidine-ring was still preserved, lost 1 to 3% of their phosphoric acid (P_i) under the experimental conditions. The alkaline decomposition of UpH_2O was used as a method for the titration of hydrated uracil residues in irradiated ribonucleic acid (RNA). Following irradiation (254 mμ) the RNA was degraded by alkali completetly to mononucleotides and three new photoproducts: compound A, ribose phosphate, and another compound B, which behaved like Up dimer. From the amount of compound A found, the number of hydrated uracils originally formed could be calculated. The kinetics of formation of the photoproducts were studied. The biological implications of these studies are discussed. (auth)

2416 MODIFICATION OF WOOD WITH PLASTICS AND RADIATION. James A. Kent (West Virginia Univ., Morgantown). p.49-61 of "Nuclear Applications to the Wood, Paper, and Pulp Industries Conference." Pullman, Wash., Washington State Univ., 1964.

The radioinduced polymerization of monomers in impregnated wood results in wood-plastic combinations with improved properties. The operations involved in the manufacture of such products are described. An experimental investigation was conducted in which the polymerization rate of vinyl acetate in wood was studied in N_2 and air, and the mechanical properties of combinations with polymethyl methacrylate and polyvinyl alcohol were determined. (D.L.C.)

2417 IRRADIATION OF POLYMERIC COMPOUNDS. Donald A. Guthrie (to Esso Research and Engineering Co.). U. S. Patent 3,121,674. Feb. 18, 1964. Filed Oct. 30, 1959.

A method is given for reducing the molecular weight of isobutylene polymers or copolymers for subsequent use as viscosity index improvers for lubricating oils. The method comprises preparing an aqueous or alcoholic emulsion of the polymer and exposing it to ionizing radiation. Several examples of the method and results obtained with it are given. (D.L.C.)

2418 RADIATION DECOMPOSITION OF WASTE CYANIDE SOLUTIONS. Richard F. Byron, John Danaczko, Jr., Alfred L. Dixon, and Lloyd M. Welker (to Western Electric Co., Inc.). U. S. Patent 3,147,213. Sept. 1, 1964. Filed July 11, 1961.

A simple method is given for decomposing for safe disposal cyanide solutions which result from many industrial operations, especially electroplating. The method comprises diluting the solutions to a cyanide concentration of 1 to 5 g/l, and exposing the diluted solutions to gamma radiation until the cyanide ions are decomposed. Data are given on the radioinduced conversion of KCN solutions as a function of CN^- concentration and radiation dose. (D.L.C.)

2419 METHOD OF TREATING LUBRICATING OIL. Edward L. Cole and Gordon H. Miller (to Texaco Inc.). U. S. Patent 3,150,077. Sept. 22, 1964. Filed Jan. 25, 1961.

A method was developed for processing a hydrocarbon lubricating oil to enhance its quality by contacting the lubricating oil with hydrogen at a hydrogen: lubricating oil ratio of at least 1000 ft^3/barrel and at an elevated temperature and pressure in the presence of a hydrogenation catalyst. The catalyst is previously subjected to ionizing radiation to an absorbed dose of at least 1×10^7 Rads. Preferred catalysts include platinized charcoal, cobalt molybdate on alumina, cobalt–nickel molybdate on alumina, molybdenum oxides and/or sulfides on alumina, and composite catalysts of aluminum, platinum, and combined halogen. The lubricating oils thus treated have a significantly higher viscosity index and/or lighter color than when non-irradiated catalysts are employed. (M.C.G.)

Radiochemistry

2420 DETERMINATION OF SPECIFIC ACTIVITIES AND IDENTIFICATION OF β-ACTIVE ISOTOPES IN THE CASE OF THICK SPECIMENS. Victor Mageru and Gheorghe Maxim. Analele Stiint. Univ. A. I. Cuza, Iasi, Sect. I, 9: 493-502(1963). (In French)

A method is given for determination of the specific activity of beta samples in plane and cylindrical geometry without the necessity of weighing the samples. The energy of the radiations that can be used to identify the isotopes present is determined simultaneously with the determination of the specific activity. If the sample contains several isotopes, the absorption curve for aluminum is resolved into straight-line components, after which the energies and weights of the isotopes in the sample can be determined. For the case in which only the total specific activity of a sample containing several isotopes is desired, a relation is given with which the activity can be calculated as a function of the initial slope of the curve of the absorption in aluminum. (tr-auth)

2421 PREPARATION OF COLLOIDAL SOLUTION OF ZIRCONYL PHOSPHATE WITH P^{32} FOR RADIOTHERAPEUTIC PURPOSES. N. B. Mikheev, E. Abdullah, and M. El-Garhy (Atomic Energy Establishment, Cairo). Kernenergie, 7: 664-7(Sept. 1964).

A method was developed for the preparation of colloidal solutions of radioactive zirconyl phosphate (labeled with ^{32}P) for radiotherapeutic application. The advantage of this preparation is that it coagulates in injected areas which limits the distribution of radioactivity in other organs. It was proved that this preparation contains less than 1% of radioactive ^{32}P in the ionic form. These preparations can be sterilized, and stored for periods more than 5 days at 5–7°C. (auth)

2422 ISOTOPIC EXCHANGE AS A CRITERION OF STRUCTURE OF COMPLEXES. I. ISOTOPIC EXCHANGE IN $[Re_2OCl_{10}]^{4-} - {}^{36}Cl^-$ SYSTEM. Stanislaw Wajda (Uniwersytet Wroclawski, Wroclaw, Poland). Nukleonika, 9: 451-70(1964). (In Polish)

The kinetics of radiochlorine exchange in μ-oxochlororhenate(IV) was investigated and it was confirmed that the bonds of the two chlorine atoms in the position trans to oxygen-bridge in $[Re_2OCl_{10}]^{4-}$-complex are weaker. The

first reaction order shows that the exchange proceeds in agreement with the dissociation mechanism S_{N1}. The activation energy and the kinetics of the exchange reaction were used to define the mechanism of the reversible equilibrium between mononuclear and binuclear complexes: $[Re_2OCl_{10}]^{4-} + H_2O \rightleftharpoons 2[ReOHCl_5]^{2-}$. (auth)

2423 INVESTIGATIONS ON DECONTAMINATING FISSIOCHEMICALLY PRODUCED HYDRAZINE. R. H. Black (Aerojet-General Nucleonics, San Ramon, Calif.). Trans. Am. Nucl. Soc., 7: 315-16(Nov. 1964).

2424 THE REMOVAL OF SODIUM CONTAMINANTS, IN ACTIVATION ANALYSIS: WITH A CENTRIFUGATION METHOD USING ION EXCHANGE PAPER IN A NOVEL PLASTIC COLUMN. William T. Burnett, Jr. and Morton D. Cohan (Armed Forces Radiobiology Research Inst., Bethesda, Md.). Trans. Am. Nucl. Soc., 7: 333-4(Nov. 1964).

2425 RAPID RADIOCHEMICAL SEPARATION METHODS FOR SILVER, CADMIUM AND INDIUM. H. V. Weiss (Naval Radiological Defense Lab., San Francisco). Trans. Am. Nucl. Soc., 7: 334(Nov. 1964).

2426 A RAPID IODINE RADIOCHEMICAL PROCEDURE. A. E. Greendale, D. L. Love, and A. A. Delucchi (Naval Radiological Defense Lab., San Francisco). Trans. Am. Nucl. Soc., 7: 334-5(Nov. 1964).

2427 A SIMPLE CARRIER-FREE IODINE RECOVERY METHOD. I. J. Gruverman (New England Nuclear Corp., Boston). Trans. Am. Nucl. Soc., 7: 345-6(Nov. 1964).

2428 SEPARATION AND PURIFICATION OF A GRAM OF PROTACTINIUM-233. J. W. Codding, J. R. Berreth, R. P. Schuman, W. H. Burgus, and R. A. Deal (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 7: 398-9(Nov. 1964).

2429 NATURAL MITIGATION OF RADIOLOGICAL HAZARDS IN SODIUM FIRES. Roscoe Koontz (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 499(Nov. 1964).

Separation Processes and Procedures

Refer also to abstract 2555.

2430 (ANL-6918) HALIDE SLAGGING OF URANIUM–PLUTONIUM ALLOYS. G. A. Bennett, L. Burris, Jr., and R. C. Vogel (Argonne National Lab., Ill.). July 1964. Contract W-31-109-eng-38. 14p. Dep.; $1.00(cy), 1(mn) OTS.

Nearly complete extraction of Ce (a stand-in for all highly electropositive fission products) from molten U-10 wt % Pu-10 wt % fissium alloys by molten halide salts was realized within one hour at 1150°C. $MgCl_2$ in a $CaCl_2$–$BaCl_2$ flux was used to oxidize the Ce and thereby effect its transfer to the molten salt phase. The molten phases were satisfactorily contained in beryllia crucibles. Flux and metal phases were separated by cooling the system to about 860°C to solidify the metal phase, and then by pouring off the still-molten salt layer. The metal phase was subsequently remelted and poured into a different mold. An alternative procedure is to pour both phases together and subsequently break apart the solidified metal and salt phases. Yields of purified metal ingots were about 98%. When 110% of the amount of $MgCl_2$ required to oxidize all of the Ce to $CeCl_3$ was employed, 98% of the Ce was removed along with less than 0.5% of the Pu. This represents a Ce–Pu separation factor of about 7000. Very little Pu (less than 0.1%) was vaporized. (auth)

2431 (HW-77023) REDOX PLANT DEMINERALIZED WATER. J. M. Skarpelos (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 22, 1963. Contract AT(45-1)-1350. 31p. Dep.(mn); $2.00(cy), 1(mn) OTS.

The Redox demineralized water system has been in operation for over ten years with few apparent operating problems. Recently, however, the failure of a stainless steel steam generator was attributed to corrosion caused by impurities in the demineralized water. A study of the demineralized water system was made to determine system and operating deficiencies. The demineralized water system and its history are described. Conclusions and recommendations are presented for improving the operation of the demineralizer installation. This study was made before problems were encountered caused by the presence of silica in the demineralized water and does not take this problem into consideration. In general, however, it can be said that the system is not designed to remove silica from the water. It is doubtful that silica can be removed with the existing equipment without causing potential corrosion problems in the aluminum distribution system and without encountering organic and silica fouling problems associated with strong base anion resins. (auth)

2432 (HW-80876) SOLVENT EXTRACTION OF CESIUM FROM HANFORD ALKALINE SUPERNATE BY 4-SEC-BUTYL-2 (α-METHYLBENZYL)PHENOL — LABORATORY STUDIES. L. A. Bray (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 1, 1964. Contract AT(45-1)-1350. 21p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A cesium solvent extractant, 4-sec-butyl-2(α-methylbenzyl) phenol, has been investigated for possible use at Hanford. The substituted phenol, diluted with a kerosene, was found to be a very selective extractant for cesium, both in the laboratory and, subsequently, in pilot-plant-scale pulse column demonstrations. The extractant provides an efficient method for cesium recovery from the very large volumes of alkaline supernate now being stored at the separations facilities. The extraction of cesium was found to depend upon the concentration of phenol, the pH of the aqueous waste solution, the temperature of the equilibration, and the aqueous Na^+ concentration. Approximately 0.3 of a mole of additional OH^- was required per liter of synthetic alkaline supernate (9M Na^+, pH 10.3) for maximum cesium extraction. Cesium distribution values are favored by a decrease in the equilibration temperature. The heat of extraction, $-\Delta H$, was found to be approximately 19 kcal. The cesium distribution ratio was also found to be inversely dependent on the sodium concentration with a slope of slightly less than −2 over the range of 1 to 8M sodium. (auth)

2433 (HW-SA-3655) THE FUELS RECYCLE PILOT PLANT. R. W. Dascenzo, K. H. Hammill, and L. G. Merker (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 29, 1964. Contract AT(45-1)-1350. 11p. (CONF-654-3). Dep.(mn); $1.00 (cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

The Fuels Recycle Pilot Plant is designed and being constructed to provide: (1) pilot mechanical and metallurgical processes on an engineering scale using plutonium and large quantities of fission products, (2) demonstration of new methods for processing fully irradiated fuels for the recovery of fissile and by-product materials and removal of poisons therefrom and subsequent treatment of high level radioactive wastes, (3) fabrication, testing, and inspection of fuel assemblies using highly radioactive fissile material, (4) cold chemical and process equipment engineering development work, and (5) engineering development of chemical processes using tracer amounts of fission products. The salient features includes a dual radiochemical and metallurgical cell complex, separately housed but integrated through a centrally located cask-handling area. Intermediate and cold chemical working areas are also located within the facility. All portions of the building were designed for safe handling and confinement of radioactive materials. (auth)

2434 (LFEN-NI.15) TRATAMENTO DE MINÉRIOS DE URÂNIO POR PERÇOLACÃO SULFÚRICA. (Treatment of Uranium Minerals by Sulfuric Acid). Henrique Carreira Pich (Portugal. Junta de Energia Nuclear. Laboratori de Fisica e Engenharia Nucleares, Sacavem). 1964. 57p. Dep.

The characteristics of the distribution of the uranium ores in the region of Guarda have led to the study of a procedure allowing the chemical treatment of its minerals economically, and adaptable to an installation easily transportable from mine to mine. The laboratory studies made with the different minerals of the region and especially with those from the Forte Velho mine are described. The procedure is based on a sulfuric wetting of the crushed ores followed by recovery of the uranium by ion exchange resins. In the case of Forte Velho ores approximately 70% of the uranium was recovered, with the ore crushed to ½ in. and the consumption of 25 kg H_2SO_4/ton ore. The semi-industrial installation, together with the tests made, is described. (tr-auth)

2435 (NAA-SR-Memo-9920) PACKLESS COLD TRAP EVALUATION. G. N. Lauben (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). June 17, 1964. Contract AT-11-1-GEN-8. 12p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A discussion of precipitation and crystallization theory as applied to the sodium–sodium oxide system is presented. HNPF packed and packless trap performance is compared. Cold trap analytical methods are presented. A test program for the packless trap installed in the LCTL and improvements of design for future traps are recommended. (auth)

2436 (NP-14343) COLLOQUY ON INSTRUMENTATION IN PLANTS FOR THE CHEMICAL REPROCESSING OF IRRADIATED FUELS, PARIS, NOVEMBER 22-23, 1963. (European Nuclear Energy Agency, Paris). 191p. (In French and English). Dep.(mn).

The fifteen papers presented at the colloquium are compiled, together with the discussions on the papers. Separate abstracts were prepared for each paper. (J.S.R.)

For abstracts of individual papers see: 2216, 2217, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, and 2747.

2437 (NP-14343(p.Ib1-10)) EXPOSE SUR LES PROBLEMES RENCONTRES A MARCOULE ET SUR L'EXPERIENCE ACQUISE DANS L'UTILISATION DES APPAREILS. (The Problems Encountered at Marcoule and the Experience Gained in the Use of Measuring Equipment). R. Martinet, J. M. Reneaud, and R. Riolfo (France. Commissariat à l'Energie Atomique. Centre de Production de Plutonium de Marcoule, Chusclan).

The measurement and control apparatus at the Pu extraction plant can be divided into classifications, classical measurement devices and measurement devices peculiar to the treatment of irradiated fuel. The first class of instruments is briefly discussed and a more detailed consideration is made of the second. Installations for the continuous measurements of neutron, α, and γ activity are described. The neutron detectors are used to measure concentration, accumulation, and criticality. Alpha counters supplement the determination of the concentration made with neutron detectors. The γ detectors are used to determine decontamination at each stage and to measure the fission product concentration. The installation and design of these instruments are described. (J.S.R.)

2438 (NP-14343(p.Ic1-23)) INSTRUMENTATION AND CONTROL PRACTICES IN U. S. A. REPROCESSING PLANTS. L. A. Jobe (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho).

A survey was made of the several component parts of systems used in reprocessing plants in the USA. Hanford, Savannah River, and Idaho Chemical Processing Plant flowsheets are used to illustrate the difficult process component block in the closed loop. Differences in design and size of equipment used in several of the flowsheets affects the process dynamic characteristics of the processes and their respective measuring and control systems. In-line analytical instruments that were developed to measure concentration of fissionable or fission product materials are: alpha monitor, colorimeter-photometer, gamma absorptiometer, gamma monitor, neutron absorptiometer, neutron monitor, neutron multiplication detector, polarograph, and x-ray monitor. These units are used for supervisory control and were not incorporated into closed loop control. Conventional density, flow, level, pressure, and temperature instruments are used for closed loop control of plant operations. In general, the same controllers, mostly pneumatic, that were originally installed in reprocessing plants, are still in use. Improved control systems, such as special-purpose analog computing relays, cascade control, etc., are being introduced into newly designed processes. Systems engineering principles were utilized in the design of calciner and evaporator controls, and, at Hanford and Oak Ridge, data loggers were used with computers. (auth)

2439 (NP-14343(p.Id1-4)) LES DEVERSOIRS SOUS VIDE; LEUR REGULATION; APPLICATIONS POSSIBLES. (Flow Rate Control by Vacuum Pot and Possible Applications). F. Mattei (Societe Saint-Gobain Nucleaire, Courbevoie, France).

The pneumatic spillway developed for use with mixers-decanters is described. The spillway operates under vacuum, and the vacuum on each spill is controlled by commercial devices. The performance of the vacuum pots tested at Marcoule were satisfactory. Some examples are given in which such a vacuum spillway could be used. (J.S.R.)

2440 (NP-14343(p.Ie1-14)) THE EUREX PLANT INSTRUMENTATION AND CONTROL. G. Calleri and L. Mannucci (Italy. Comitato Nazionale Energia Nucleare, Milan).

The Eurex reprocessing plant was designed for processing Al-clad Al–U fuel elements of the PTR type having ^{235}U enrichments of either 20 or 93%. The instrumentation of the facility is divided into process instrumentation, ventilation system instrumentation, fire-fighting instrumentation, mechanical instrumentation, and control-room instrumentation. The criteria in the instrumentation design for each of these classifications are discussed. The layout of the plant facilities and equipment is sketched, and the types of instruments used in each classification are indicated. (J.S.R.)

2441 (NP-14343(p.If1-13)) COMMENT ONT ETE RESOLUS LES PROBLEMES GENERAUX D'INSTRUMENTATION A EUROCHEMIC. (The Solving of Eurochemic's Instrumentation Problems). Alain Mongon (European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium).

The plan of the processing building is briefly described and criteria for the selection of the instrumentation of the process are given. The conventional measurements required are level, interface level, density, temperature, and output. The instrumentation for these are briefly described with emphasis on the special adaptations needed. The nuclear instrumentation is also considered. The special problems encountered with control of the intercycle evaporator, control of the dissolver, operation of the siphons, alarm system, and control of the output are discussed. Operation of the five control tables is described. (J.S.R.)

2442 (NP-14343(p.Ig1-9)) AUTOMATIC AND SEMI-AUTOMATIC SAMPLING AND ANALYTICAL INSTRUMENTATION IN WINDSCALE FUEL RE-PROCESSING PLANTS. F. J. Woodman (United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England).

Some automatic and semi-automatic instrumentation was developed at Windscale for use on continuous irradiated fuel processing plants. Despite advances in instrumentation it is still necessary to take certain types of

samples to the laboratory for analysis and in these cases special sampling equipment may be essential; one such example for sampling highly active process streams is described. Sometimes savings in analytical costs can be made by using an automatic instrument in the plant but not actually in-line. The samples in this case are presented manually to the instrument by a process operator unskilled in analysis and the complete analysis is automatically carried out for him. An example of this class of instrument for free acidity determination in plutonium solutions is described. Finally two examples of actual in-line instruments are described, one for uranium or plutonium measurements in substantially pure solutions by gamma absorption and one for measurement of ferrous sulfamate concentrations in process feed solutions. (auth)

2443 (NP-14343(p.IIb1-9)) DOSAGE DES FLUORURES VOLATILS EN CONTINU UTILISANT LA RADIOACTIVITE. (Continuous Dosage of Volatile Fluorides Using Radioactivity). P. Faugeras, M. Bourgeois, Ph. Berard, G. Manevy, H. Marlin, and J. Stratakis (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Fontenay-aux-Roses).

In the processing of irradiated fuel elements by the fluoride volatility method, continuous determination of the fluorides is necessary. The first results obtained in determination of UF_6 by α and γ counting and of PuF_6 by neutron counting are reported. Principles of the measurement methods and the measurement devices used are described. Modifications, which would improve the precision and reduce the divergences in the results, are discussed. (J.S.R.)

2444 (NP-14343(p.IIc1-12)) AMELIORATION DES PROCEDES NUCLEAIRES D'ANALYSES CONTINUES DES USINES DE TRAITMENT DE COMBUSTIBLES IRRADIES. (The Improvement of Continuous Nuclear Analysis Processes in Irradiated Fuel Reprocessing Plants). J. Chabert (France. Commissariat à l'Énergie Atomique, Paris).

The devices used for continuous determination of Pu and fission product concentrations in fuel processing plants were studied in order to improve their precision and reliability. The Pu determination was made by measurement of α emission at low concentrations and of neutron emission at high concentrations. The fission products were determined by their γ emission. The principal difficulties found in measurement of the α activity of the solutions were tabulated, and the particular solutions adopted for these difficulties are discussed. Elimination of the adsorption of fission products along the canals is described. Construction of the associated electronics is reported. (J.S.R.)

2445 (NP-14343(p.IIg1-7)) STUDIES OF IN-LINE INSTRUMENTATION AT EUROCHEMIC. Lennart Svansson (European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium).

The instrument location and environmental conditions at the Eurochemic fuel processing plant are discussed. The types of instruments and their characteristics are described. The gamma monitor, alpha monitor, and ^{241}Am absorption measurements for continuous measurements on process streams are under study and the preliminary results are reported. (J.S.R.)

2446 (NP-14343(p.IIIb1-8)) THE ROLE OF A UNIT SYSTEM AND ITS APPLICATION TO DATA PROCESSING. H. Bisby (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

The requirements for instrumentation in large complex processing plants are often in contradiction with each other, but are not widely dissimilar to those for instrumentation in a research organization for which a unit system of electronics was devised. The role of a unit system of electronic equipment (Harwell 2000 Series), the design principles, and the advantages are tabulated. The application of such a system to analytical services of a large processing plant is discussed, and the type of data required for any particular sample in a processing plant is reported. The recording system, absolute time recording, and recording machines for such a unit system are discussed. (J.S.R.)

2447 (NP-14343(p.IIIc1-5)) L'INSTRUMENTATION PREVUE A UP2 POUR LE CONTROLE ET LA REGULATION. (Instrumentation and Control Envisaged for the UP-2 Plant). M. Kermagoret (France. Commissariat à l'Énergie Atomique, Paris) and R. Turpin (Société Saint-Gobain Nucléaire, Courbevoie, France).

Instrumentation and control envisaged for the UP-2 plant at The Hague for processing irradiated fuel are reviewed. The emphasis is on modifications made on the apparatus used at Marcoule during five years of operation. The measurements and controls considered are: input measurements; level measurements; measurement of the uranium content; control of the feed input by overspill under vacuum; control of the interphase levels in extraction batteries; control chains for input, level, and density; radioactive control of the process; numerical recorders; control rooms; and synoptic control tables. (J.S.R.)

2448 (NP-14343(p.IIId1-6)) EXPOSÉ DE QUELQUES PROBLÈMES EN COURS DE RÉSOLUTION ET DES MÉTHODES UTILISEES À CETTE FIN. (Some Problems under Current Study at Eurochemic and the Methods Used in Their Solution). Jean Challe (European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium).

Problems under current study at Eurochemic are: determination of the uranyl nitrate concentration of solutions leaving the intercycle evaporator, calculation of the number of theoretical stages of an extraction column, and development of a unit system for data processing. The uranyl nitrate concentration is to be determined by digital transposition of a graphic calculation by iteration. Some magnitudes of the second extraction cycle that are not directly measured are reviewed, and an indication is given of how they can be determined by use of the unit system for data processing. (J.S.R.)

2449 (ORNL-2398) CARBURIZATION AND CHEMICAL TREATMENTS FOR RECOVERY OF URANIUM FROM STAINLESS STEEL FUEL ELEMENTS. R. E. Adams and E. S. Bomar, Jr. (Oak Ridge National Lab., Tenn.). Nov. 1964. Contract W-7405-eng-26. 56p. Dep.; $3.00(cy), 2(mn) OTS.

Metallurgical treatments were investigated to simplify reprocessing of spent stainless steel fuel elements. Gas carburization and heat treatments were used to destroy the corrosion resistance of the fuel element material so that simple chemical treatments could expose and dissolve the unburned uranium. The objective has been to develop specific combinations of metallurgical and chemical techniques that would permit the use of conventional stainless steel equipment for dissolution and subsequent separations. Two promising processes were demonstrated on the plate-type fuel elements developed for the Army Package Power Reactor, in which uranium dioxide is dispersed in a matrix of stainless steel. In the first process, approximately 2.5% C was introduced into the 0.030-in.-thick dispersion plates by treatment with a stream of 18% CH_4 in dry hydrogen for 4 hr at 950°C or 1 hr at 1050°C. Homogenization for 2 hr at 1100°C distributed the carbon uniformly. Thus treated, the stainless steel dissolved in 4 to 6 hr in boiling 3M HNO_3, leaving a residue of insoluble chromium-containing carbides. The acid solution from small-scale tests contained up to 99.98% of the uranium. 99.89% of the uranium was recovered in a single test with a full-size APPR fuel element. In the second process, approximately 0.3% C was introduced by briefer carburization. After homogenization for 2 hr at 1150°C and sensitization for 2 hr at 650°C, the stainless steel matrix was disintegrated by intergranular attack with acidified copper sulfate solution. Approximately 80% of the stainless steel and all of the uranium oxide were left undissolved. 99.5% of the uranium was then recovered by leaching the residue with 10M HNO_3. The advantages of these processes are that (1) the chemical solutions used are essentially inert to stainless steel so that conventional dissolvers and piping may be used, (2) the unburned uranium is recovered in nitric acid solu-

tions, which are compatible with existing processes and equipment for uranium purification, and (3) the radioactive waste volumes are decreased because 20 to 80% of the stainless steel is left for storage as chemically inert solids and the uranium is dissolved in a relatively small volume. (auth)

2450 (ORNL-tr-300) THE USE OF AN ION EXCHANGE RESIN AS THE AQUEOUS PHASE CARRIER IN PARTITION CHROMATOGRAPHY. THE SEPARATION OF Zn, Cd, AND Hg. L. N. Moskvin, B. K. Preobrazhenskii, and L. N. Rzhanitsyna. Translated by S. J. Rimshaw and Joe F. Allen (Oak Ridge National Lab., Tenn.) from Radiokhimiya 5: 299-304(1963). 13p. Dep.(mn); $1.00(cy) 1(mn) OTS; $1.60(fs), $0.80(mf) JCL.

The possibility of carrying out chromatographic separations by a solvent extraction mechanism was demonstrated by stabilization of the aqueous phase on a KU-2 ion exchange resin. In the process the electrolytes are retained primarily in the hydrated film surrounding the resin particles and the composition of the film can be strictly controlled by preliminary treatment of the column. A scheme for separating Zn, Cd, and Hg by this method was devised. (auth)

2451 ANION-EXCHANGE SEPARATION OF URANIUM FROM THE LANTHANIDES. I. Hazan and J. Korkisch (Universität, Vienna). Anal. Chim. Acta, 31: 467-71(Nov. 1964).

The anion-exchange behavior of uranium and the lanthanides in acetic acid–organic solvent mixtures is described. The distribution coefficients of the elements in 13 organic solvents containing acetic acid as the complexing agent were measured, and methods for the quantitative separation of uranium from the rare earth elements are proposed. (auth)

2452 DEVELOPMENT OF PROCESSES FOR NUCLEAR FUEL RECOVERY. PART I. PYROMETALLURGICAL PROCESSES. Argonne Natl. Lab. Rev., 1: No. 4, 3-6(Oct. 1964).

The pyrometallurgical processes for reactor fuel recovery are described and its advantages and applicability are discussed. The EBR-II fuel processing plant, a pilot plant for the study of pyrometallurgical recovery processes is also discussed. The liquid metal process for reclamation of EBR-II melt refining skulls, flowsheet for EBR-II process, and the conceptual pyrometallurgical process for uranium–plutonium alloy fuel are discussed and illustrated schematically. (P.C.H.)

2453 ION-EXCHANGE PURIFICATION OF RADIOISOTOPES AT THE ORNL ISOTOPES DEVELOPMENT CENTER. P. B. Orr. Isotopes Radiation Technol., 2: No. 1, 1-5(1964).

Ion exchange is often used in conjunction with solvent extraction or precipitation to separate and purify rare earths and radioisotopes. The choice of ion-exchange material and eluant is discussed, and the problem of radio-induced decomposition is considered. Column feed and eluant flow rate are discussed briefly. Processing equipment used in the separations is described. (D.L.C.)

2454 ISOLATION OF RADIUM FROM URANIUM SOLUTIONS BY "SYNCHRONIZED" PRECIPITATION WITH BARIUM CHROMATE. Tadeusz Adamski and Roza Przytycka (Inst. of Nuclear Research, Warsaw). Nukleonika, 9: 725-32(1964).

The isolation of radium from uranium solutions by synchronized precipitation was studied. It was found that radium may be removed from uranium ore leaches by means of coprecipitation using barium chromate. All other substances present in the solutions obtained from leaching uranium ore have no effect on this process. The pH value of the initial solution has a primordial effect on the efficiency of the coprecipitation process of radium with barium chromate. The radium is entirely precipitated with barium chromate at pH > 5. The quantity of added barium also has a remarkable effect on the efficiency of the process. (P.C.H.)

2455 A THERMOSTATIC SYSTEM FOR SEPARATION AND PURIFICATION OF GASES USED IN IONIZATION RADIATION DETECTORS. Jozef Tadeusz Riedel. Przeglad Elektron., 5: 365-75(Aug. 1964). (In Polish)

2456 CHLORINATION AS A MEANS OF REMOVING URANIUM AND THORIUM FROM FUELED-GRAPHITE MATERIALS. J. L. Cook and R. L. Hamner (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 396(Nov. 1964).

2457 A PILOT PLANT FOR FLUID-BED FLUORIDE VOLATILITY PROCESSING OF URANIUM DIOXIDE–PLUTONIUM DIOXIDE REACTOR FUELS. G. J. Vogel, E. L. Carls, N. M. Levitz, and M. J. Mecham (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 396-7(Nov. 1964).

2458 PROCESSING OF PLUTONIUM BY ION EXCHANGE VS. ANION-EXCHANGE SORPTION FROM MIXED NITRIC ACID–ALUMINUM NITRATE SOLVENTS. D. B. James (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nucl. Soc., 7: 397-8(Nov. 1964). (LA-DC-6535)

2459 PILOT SCALE ALPHA-GAMMA FACILITY FOR REPROCESSING OF SPENT REACTOR CERAMIC FUELS BY VOLATILIZATION OF FLUORIDES. R. Heremans (Centre d'Étude de l'Énergie Nucléaire, Mol, Belg.), J. Schmets, J. Broothaerts, M. Haegeman, R. De Beukelaer, A. Buyle, and H. Leponge. Trans. Am. Nucl. Soc., 7: 467-8(Nov. 1964).

2460 RECOVERY OF URANIUM AND VANADIUM VALUES. Robert E. Reusser and James L. Hart (to Phillips Petroleum Co.). U. S. Patent 3,151,932. Oct. 6, 1964. Filed Dec. 8, 1961.

A process was developed for recovering uranium and vanadium from materials containing these metals and for recovering vanadium from an aqueous basic solution containing vanadium and carbonate ions. For recovery of vanadium from the aqueous solution obtained from the leaching of roasted yellow cake, the solution was contacted with an amount of lime sufficient to precipitate the carbonate ions present in the solution and with enough calcium sulfate to precipitate the vanadium values as calcium vanadate. The calcium vanadate was then treated with a sulfate-containing compound for the regeneration of calcium sulfate, which is recycled to the vanadium precipitation step. Several examples are described. (M.C.G.)

2461 ELEMENT 95 AND METHOD OF PRODUCING SAID ELEMENT. Glenn T. Seaborg (to U. S. Atomic Energy Commission). U. S. Patent 3,156,523. Nov. 10, 1964.

A method of separating americium from an aqueous solution, using a lanthanide as carrier, is described. (AEC)

2462 STAINLESS STEEL DECLADDING. L. P. Hatch, J. J. Reilly, C. B. Bartlett, and R. Johnson (to U. S. Atomic Energy Commission). U. S. Patent 3,156,526. Nov. 10, 1964.

A process for removing layers of stainless steel from clad bodies (fuel elements) is described, comprising contacting the body in a fluidized bed made up of aluminum oxide particles sequentially with fluorine (400–450°C) and oxygen (675–725°C) and thereafter recovering the uranium. (AEC)

2463 IMPROVED SOLVENT EXTRACTION PROCESS. Leland L. Burger (to U. S. Atomic Energy Commission). U. S. Patent 3,157,463. Nov. 17, 1964.

A process is described for extracting uranium and plutonium with or from hexone or tributyl phosphate from or with an aqueous nitric acid solution away from fission products in the presence of colloidal matter. By the addition of from 50 to 350 parts by weight of bentonite or talc per million parts of aqueous solution phase separation is facilitated, and the colloidal matter settles in the interface in the form of a scum. (AEC)

2464 PROCESS OF PRECIPITATING PLUTONIUM AND COMPOUNDS FORMED THEREBY. Glenn T. Seaborg, John E. Willard, and Stanley G. Thompson (to U. S.

Atomic Energy Commission). U. S. Patent 3,158,614. Nov. 24, 1964.

A method is described for the selective precipitation of plutonium from aqueous solutions with 8-hydroxyquinoline, quinaldinic acid, salicylaldoxime, salicylic acid, salicylaldehyde or 2,3-dihydroxy-5-tert-butyl-benzalethylenediamine. The chelate complex of plutonium with 8-hydroxyquinoline is also claimed. (AEC)

ENGINEERING

General

2465 (BNL-7447) ENERGY STORAGE FOR AUTOMOTIVE USE. Richard H. Wiswall, Jr. (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract AT-30-2-GEN-16. 22p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The possible use of nuclear energy stored in batteries to operate automobiles is discussed. A survey is made of some ways in which energy could be stored in chemical form and recovered as the output of galvanic cells. Both once-through fuels and regenerative systems are considered, and their characteristics are compared. The development of energy storage systems in the future is discussed briefly. (D.L.C.)

2466 (HW-SA-3261) NOMOGRAPH FOR FINDING CONCENTRATION CHANGES IN THE Nth VESSEL OF A SERIES. [W. L. Godfrey and R. A. Watrous] (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Nov. 1, 1963]. Contract AT(45-1)-1350. 2p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A nomograph is given for finding concentration changes of a single phase through a series of well-mixed stages which feed each other in turn, such as in a series of mixer-settlers. All stages are assumed to be equal in volume and to begin at equal concentrations, and the feed rates to the stages are assumed to be equal. (D.L.C.)

2467 (JPLAI-LS-587) ELECTRIC PROPULSION. Judith Hayes, comp. (California Inst. of Tech., Pasadena. Jet Propulsion Lab.). June 1964. Contract NAS 7-100. 120p.

A total of 551 references (with abstracts) is presented in chronological order for electromagnetic, electrostatic, electrothermal, and nuclear-electric propulsion systems. Author and corporate-source indexes are included. (R.E.U.)

2468 (NAA-SR-Memo-10175) REPORT OF EVALUATION TESTING OF NOVATHENE INSULATION LOW-TEMPERATURE WIRE. J. M. Townson (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). July 6, 1964. Contract AT-11-1-GEN-8. 8p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Two Novathene-insulated low-temperature wires (single-conductor-shielded and three-conductor-shielded) were bent sharply and subjected to thermal-vacuum testing. Insulation resistances were monitored while the tests were carried out at 200, 250, and 300°F. No change in insulation resistance occurred except for a small decrease at 300°F. It is concluded that the wire is suitable for use in SNAP-10A at the specified limit of 140°F at reduced pressure. (D.L.C.)

2469 (PAN-520/IX) POMIAR SZCZELINY W LOZYSKU GAZOWYM. (Slot Measurement of a Gas Bearing). J. Dziedzic (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). May 1964. 27p. Dep.

The electronic method of the measurement of the shaft position within the bush is presented. In the case considered, the lubrication of the bearing is performed by use of the gas. The transducers of the throttle type are used to measure the shaft position. Shaft movements cause variations in the impedance of inductive transducers which in turn cause the unbalancing of the a-c bridge of which they are part. The bridge output, in the form of an amplitude-modulated carrier, is supplied to an a-c amplifier and then demodulated and transferred to the plates of a cathode-ray oscilloscope. A plot of shaft movement can be obtained by monitoring the shaft position with respect to the bush in two diameters at right angles and by supplying the demodulator outputs to the X- and Y-plates of oscilloscope. The Telec camera is used to record the shaft movement in the time domain. The record is obtained on the oscillograph film with a time resolution of 0.01 sec. The apparatus can be used for shaft diameter of 2 in. and for rotation of 20,000 rpm. (auth)

2470 (PAN-521/IX) THE GEOMETRICAL PROBLEMS OF THE IDEAL FIXED BED. A. Wierusz (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). May 1964. 23p. Dep.

An explanation is given of the main geometrical factors of the fixed beds with regular and hexagonal lattices formed by identical spheres contained in the cylindrical vessel. The expressions for the number of spheres in the bed, the constriction, and the void coefficients for the bed as functions of the vessel dimensionless diameter are given. Some results of the calculations performed on the digital computer for dimensionless diameter from 3 to 1000 are presented. (auth)

2471 (SC-DC-64-1591) SANDIA AND THE VELA SATELLITE PROGRAM. [H. H. Patterson] (Sandia Corp., Albuquerque, N. Mex.). [Oct. 1964]. Contract [AT(29-1)-789]. 10p. (CONF-797-3). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Society of Mechanical Engineers, Albuquerque, N. Mex., Oct. 1964.

The Vela Satellite program for detection of nuclear weapons detonations in space is discussed with primary interest in the electronic logic circuitry being developed for detector signal transformation and transmission to ground stations. A brief description of the STL–Air Force satellite is given. (R.E.U.)

2472 INVESTIGATION OF GASOLINE-ENGINE WEAR BY THE NEUTRON-ACTIVATION TECHNIQUE. William P. Miller and John C. Newcomb. Trend Eng. Univ. Wash., 16: No. 2, 5-7(Apr. 1964).

An apparently unique method, the neutron-activation technique, was used in studying cold wear of gasoline engines. The procedure was judged successful since its over-all accuracy was estimated as ±10%. This method of analysis offers prospects of application to other problems. (auth)

Applications of Nuclear Explosions

2473 (UCRL-7916) THEORY OF NUCLEAR EXPLOSION IN A CAVITY INCLUDING THE EFFECTS OF SHOCK AND NONELASTIC EFFECTS ON THE WALL AND COMPARISON WITH TAMPED EXPLOSIONS— PROJECT DRIBBLE. Dan W. Patterson (California. Univ., Livermore. Lawrence Radiation Lab.). June 8, 1964. Contract W-7405-eng-48. 101p. Dep.(mn); $4.00(cy), 3(mn) OTS.

Theoretical studies preparatory to Project Dribble underground nuclear explosions are presented. The study is directed toward determining the effect of the initial pressure spikes on the behavior of the cavity wall; Dribble currently includes in its schedule a 5-kt tamped shot, a 100-t tamped shot, and a 100-t shot in a 15-m radius cavity in a Mississippi salt dome. Several computer codes used in the analysis are described. (R.E.U.)

2474 ENGINEERING WITH NUCLEAR EXPLOSIVES. Carl R. Gerber. Chem. Eng., 71: No. 14, 117-20 (July 6, 1964).

The applications and hazards of thermonuclear devices in excavation and mining projects are discussed. The four basic hazards involved in cratering include radiation, air blast, base surge, and ground shock. Nuclear experiments in excavation and mining are briefly mentioned. (P.C.H.)

Facilities and Equipment

Refer also to abstracts 2649, 2671, and 3725.

2475 (HW-81973) TESTING AND USE OF A NEW TYPE OF FLARELESS TUBING FITTING. C. W. Ward (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). June 29, 1964. Contract AT(45-1)-1350. 49p. Dep.(mn); $2.00(cy), 2 (mn) OTS.

The "H" fitting is a permanent grip-type tubing fitting consisting of one sleeve and two slides. The tubing ends to be joined are inserted into the sleeve which contains annular serrations on its inner surface, and the slides are forced over the sleeve to deform the tubes into the serrations. Numerous tests were conducted on Inconel-X "H" fittings, and they were found to be adequate for use in joining instrument tubing lines in the N-Reactor. The tests included stress corrosion cracking, tensile tests, thermal cycling, vibration tests, burst tests, etc. (D.L.C.)

2476 PNEUMATIC FACILITY FOR FAST IRRADIATION. Antal Csöke, Istvan Péter, and Karoly Kertész. Magy. Tud. Akad. Kozp. Fiz. Kut. Int. Kozlemen, 12: 385-93(1964). (In Hungarian)

An apparatus developed for the fast introduction and removal of targets to be irradiated in the reactor core is described. The return of the target from the core takes less than 5 sec. (auth)

2477 COMPONENTS. Power Reactor Technol., 7: 372-5(1964).

A diaphragm pump for liquid metals and a centrifugal-displacement pump for boiling fluids are described. The fabrication of the primary heat exchanger for the Molten-Salt Reactor Experiment is described briefly. (D.L.C.)

2478 A NINE-STATION ALPHA-GAMMA FACILITY. James H. Saling, Elmer C. Lusk, and John E. Gates (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nucl. Soc., 7: 459(Nov. 1964).

2479 DESIGN AND EQUIPMENT OF THE ALPHA-GAMMA HOT CELL FACILITY AT THE KARLSRUHE NUCLEAR RESEARCH CENTER. G. Boehme and P. Gottlob (Nuclear Research Center, Karlsruhe, Ger.). Trans. Am. Nucl. Soc., 7: 459-60(Nov. 1964).

2480 A NEW TYPE OF CHEMISTRY CELL FOR HIGH SPECIFIC ACTIVITY AT FONTENAY-AUX-ROSES. G. Lefort (Commissariat à l'Énergie Atomique, Fontenay-aux-Roses, France). Trans. Am. Nucl. Soc., 7: 460-1(Nov. 1964).

2481 50 KILOCURIE GAMMA IRRADIATION FACILITY. Robert M. Jefferson (Sandia Lab., Albuquerque, N. Mex.). Trans. Am. Nucl. Soc., 7: 461(Nov. 1964).

2482 CONCRETE HOT CELLS FOR DISMANTLING AND MACHINING AT THE ISPRA RESEARCH CENTER. P. Barthelemy, G. Bonnet, J. Junger, J. Cauwe, and R. Klersy (Euratom, Ispra, Italy). Trans. Am. Nucl. Soc., 7: 462(Nov. 1964).

2483 DEFLECTOR TO PREVENT SUCTION OF SMOKE INTO CHIMNEY SLIPSTREAMS AT HIGH WIND SPEEDS. R. Sallé (Commissariat à l'Énergie Atomique, Paris). Trans. Am. Nucl. Soc., 7: 462-3(Nov. 1964).

2484 THE U. S. NAVAL RESEARCH LABORATORY HIGH LEVEL RADIATION LABORATORY. H. E. Watson and L. E. Steele (Naval Research Lab., Washington, D. C.). Trans. Am. Nucl. Soc., 7: 463(Nov. 1964).

2485 FUELS RECYCLE PILOT PLANT. R. W. Dascenzo, K. H. Hammill, and L. G. Merker (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 464(Nov. 1964).

2486 THROUGH-THE-WALL MASTER-SLAVE MANIPULATOR WITH INDEXING DEVICE FOR FORWARD AND BACKWARD MOVEMENT. J. Vertut (Commissariat à l'Énergie Atomique, Saclay). Trans. Am. Nucl. Soc., 7: 465(Nov. 1964).

2487 A COMPACT AND FLEXIBLE SERVOSYSTEM FOR MASTER-SLAVE ELECTRIC MANIPULATOR. L. Galbiati, C. Mancini, T. Raimondi, and F. Roncaglia (Comitato Nazionale per l'Energia Nucleaire, Casaccia, Italy). Trans. Am. Nucl. Soc., 7: 465-6(Nov. 1964).

2488 REMOTELY-OPERATED SERVICE MODULE FOR MAINTENANCE OF ORBITING SYSTEMS. C. E. Vivian, W. H. Wilkins, and L. L. Haas (Lockheed Missile and Space Co., Sunnyvale, Calif.). Trans. Am. Nucl. Soc., 7: 466(Nov. 1964).

2489 A TAXONOMY FOR REMOTELY OPERATED SYSTEMS. John W. Clark (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nucl. Soc., 7: 466-7(Nov. 1964).

2490 MANIPULATOR DEVELOPMENT AT THE ANL. Ray Goertz (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 467(Nov. 1964).

2491 ADAC—DESIGN OF ALPHA, BETA, GAMMA CELLS WITH ALPHA BACK CELLS FOR MAINTENANCE AND TRANSFER FACILITIES. R. Mas (Commissariat a l'Energie Atomique, Paris), A. Tarbe de Saint-Hardouin, and P. Lecouvreur. Trans. Am. Nucl. Soc., 7: 468(Nov. 1964).

2492 ADAC—OPERATION OF A FUEL DISMANTLING LINE IN A CELL MOCKUP. R. Mas (Commissariat à l'Énergie Atomique, Paris), V. Gerard, and A. Tarbe de Saint-Hardouin. Trans. Am. Nucl. Soc., 7: 469(Nov. 1964).

2493 A NEW TYPE OF AIRTIGHT TONG FOR MASTER-SLAVE MANIPULATORS. G. Lefort (Commissariat à l'Énergie Atomique, Paris). J. P. Cazalis, and J. Rouillard. Trans. Am. Nucl. Soc., 7: 469-70(Nov. 1964).

2494 OPERATIONAL EXPERIENCE OF THE BR2 HOT CELLS. J. P. Valentin (Centre d'Étude de l'Énergie Nucléaire, Mol, Belg.). Trans. Am. Nucl. Soc., 7: 472-3 (Nov. 1964).

2495 REMOTELY OPERABLE HIGH PRECISION DIMENSIONING EQUIPMENT ACCURATE TO ±0.0002 IN. J. D. Eichenberg, F. J. Lennon, and K. L. Rupp (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 474(Nov. 1964).

2496 AN INERT-ATMOSPHERE, GLOVEBOXED EXTRUSION PRESS. G. Burton, Jr., and A. B. Shuck (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 475 (Nov. 1964).

2497 PNEUMATIC TRANSFER "FLASH" IRRADIATION DEVICE. J. Vertut and R. Seran (Commissariat à l'Énergie Atomique, Saclay). Trans. Am. Nucl. Soc., 7: 476(Nov. 1964).

2498 IN-CELL VACUUM IMPREGNATION OF METALLOGRAPHY SPECIMENS. F. L. Cochran and H. E. Shoemaker (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 476-7(Nov. 1964).

2499 OPERATING EXPERINECE IN A SEMI-REMOTE FACILITY FOR FABRICATION OF FUEL RODS CONTAINING $(U^{233},Th)O_2$. J. E. Van Cleve, Jr., and A. L. Lotts (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 478-9(Nov. 1964).

2500 THE ANL ALPHA-GAMMA METALLURGY HOT CELL—ITS DESIGN PHILOSOPHY AND COMPONENTS. R. C. Goertz, K. R. Ferguson, J. F. Lindberg, et al. (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 483-4(Nov. 1964).

2501 STARTUP OF THE ANL ALPHA-GAMMA METALLURGY HOT CELL. F. L. Brown and B. J. Koprowski (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 484(Nov. 1964).

2502 A SYSTEM FOR A NITROGEN ATMOSPHERE IN AN ALPHA-GAMMA HOT CELL. B. J. Koprowski, W. H. Livernash, and F. L. Brown (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 484-5(Nov. 1964).

2503 ACCESSORIES DEVELOPED FOR FIBERGLAS REINFORCED PLASTIC GLOVEBOXES IN THE RESEARCH HOT LABORATORY. J. P. Hughes and F. J. Schmitz (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 485-6(Nov. 1964).

2504 THE LOS ALAMOS "WING 9" ALPHA-GAMMA BOX SYSTEM. C. C. Burwell, J. W. Schulte, and M. T. Wilson (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nucl. Soc., 7: 486(Nov. 1964).

2505 REMOTELY-OPERATED TRANS-PLUTONIUM CHEMICAL PROCESS CELLS. M. S. Coops, C. L. Hanson, R. W. Hawk, and V. E. Scribner (Univ. of California, Livermore). Trans. Am. Nucl. Soc., 7: 486-7(Nov. 1964).

2506 EQUIPMENT ADVANCES IN THE TRANS-CURIUM ELEMENT RADIOCHEMISTRY FACILITY. M. S. Coops, V. E. Scribner, and C. L. Hanson (Univ. of California, Livermore). Trans. Am. Nucl. Soc., 7: 487-8(Nov. 1964).

2507 R-F GENERATION OF THERMAL PLASMAS. C. W. Marynowski and A. G. Monroe (Stanford Research Inst., Menlo Park, Calif.). p.67-84 of "High Temperature Technology." Washington, D. C., Butterworths, 1964.

The main features of r-f plasma torches are summarized, together with the results of observations on the operating characteristics of such torches. Arc-plasma and r-f heating are also compared; and the uses of r-f heating in crystal growing, production of spherical particles, and chemistry are indicated. (D.C.W.)

2508 APPARATUS FOR MANIPULATING RADIOACTIVE MATERIAL TO AND FROM A STORAGE CHAMBER. Robert J. Prest (to Technical Operations Inc.). U. S. Patent 3,147,383. Sept. 1, 1964. Filed May 16, 1962.

A radiographic device is designed for manipulating radioactive materials. The device includes a storage body, a conduit, and control cable means for moving a radioactive capsule between the conduit and storage body. Means is also provided for quickly coupling and uncoupling the control cable to the capsule. (D.L.C.)

2509 CONTROL VALVE OPERATING MECHANISM. Didier Costes (to Commissariat à l'Energie Atomique). U. S. Patent 3,150,688. Sept. 29, 1964. Priority date Aug. 18, 1961, France.

A remote valve-operating device is described. It provides one mechanism to operate any of a number of valves through a biological shield. An inspection device may be placed within the operating shaft to indicate the state of the valve being operated. (T.R.H.)

2510 ULTRA-CLEAN ROOM. W. J. Whitfield (to U. S. Atomic Energy Commission). U. S. Patent 3,158,457. Nov. 24, 1964.

A method is described by which the air in work areas can be maintained at cleanliness levels below 1000 particles (0.3 μ or larger)/ft^3 of air. (D.C.W.)

Heat Transfer and Fluid Flow

Refer also to abstracts 3482, 3483, and 3701.

2511 (AEEW-R-356) BOILING WATER HEAT TRANSFER BURNOUT IN UNIFORMLY HEATED ROUND TUBES: A COMPILATION OF WORLD DATA WITH ACCURATE CORRELATIONS. B. Thompson and R. V. Macbeth (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). July 1964. 27p. Dep.; $3.20(BIS); 16s. 0d. (HMSO).

All available World burn-out data for vertical, uniformly heated round tubes, with liquid water inlet, have been compiled and are presented in systematic order. A total of 4389 experimental results is recorded, covering a very extensive range of parameters. Detailed examination of these data over the years has indicated a number of inconsistencies and these are discussed. The majority of the data fall into four main pressure groups: 560, 1000, 1550, and 2000 psia, and accurate correlations of these data are presented together with error distribution histograms and graphical aids to rapid calculation of burn-out flux. (auth)

2512 (AERE-R-4630) THE DEVELOPMENT AND MANUFACTURE OF ELECTRICALLY HEATED FLOW CHANNELS FOR BOILING PRESSURE-DROP EXPERIMENTS. M. W. George and W. Redpath (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). July 1964. 31p. Dep.; (BIS).

A description is given of the development, construction, and testing of equipment used for studying pressure drop under subcooled nucleate-boiling conditions within a flow channel similar to that of a DIDO Mark III M.T.R. fuel element. Design and construction of the heaters and experience obtained in bonding stainless steel to other materials are described. (auth)

2513 (NAA-SR-Memo-10239) STATIC CHECK VALVE EVALUATION. I. E. Randall (Atomic International. Div. of North American Aviation, Inc., Canoga Park, Calif.). July 28, 1964. Contract AT(11-1)-Gen-8. 30p. Dep.(mn); $2.00(cy), 1(mn) OTS.

A static check valve has application for the NaK and mercury loops of the Mercury Rankine system. It has no moving parts, therefore, it is simple and reliable. An analytical study and prototype tests were made to evaluate the Tesla valve for this application. Water flow tests were made, and movies were taken using unity oil as a flow indicator. The analytical study corresponded reasonably well with the test data. It was determined that the Tesla valve does not meet the requirements of the Mercury Rankine system. These requirements specified a ratio of reverse-to-forward flow resistances of 360:1 minimum. The best resistance ratio obtained in the test series was 2:1. An improved Tesla valve could produce as high as a 16:1 resistance ratio, which is good for some applications, but not for the present one. (auth)

2514 (PWA-2315) EXPERIMENTAL CONDENSING-FLOW STABILITY STUDIES. S. S. Wyde and H. R. Kunz (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). Apr. 15, 1964. Contract NAS3-2335. 139p. (NASA-CR-54178)

An experimental program was conducted to investigate stability of condensing steam flow inside tubes to aid in the design of Rankine-cycle space power plants. As a result of the investigation it can be concluded that slugging is likely to occur inside tubes in zero-gravity at high condensing rates. This slugging causes pressure oscillations, which must be taken into account in the power plant component structure. In addition, slugging might cause possible pump cavitation problems. These problems may be more severe in ground tests of a space power plant. The magnitude of the pressure oscillations can be reduced by the use of inserts in the tubes. Furthermore, meteoroid puncture in a radiator segment with a subsequent loss of coolant to one of a number of parallel condensers might result in violent pressure oscillations. These oscillations could also lead to pump cavitation and system failure. Oscillations can be reduced by the use of orifices in the condensing tube exits. The program was divided into four parts: (1) glass-tube tests to coordinate visual observations with transient pressure measurements; (2) single-metal-tube tests to determine the effects on slugging of gravity, tube diameter, and inserts within the tube; (3) simulated segmented shell-tube indirect condenser tests to determine the effects of partial coolant loss with different orientations and cooling arrangements; and (4) simulated condensing-radiator tests to determine the effects of gravity on condensing flow in this configuration. The

tests (1, 2, and 3) indicated that large pressure fluctuations would occur if considerable amounts of vapor entered the exit manifold. This detrimental effect occurred only when the second type cooling arrangement was used without orifices installed in the tube exits. The use of orifices apparently allowed only a small amount of vapor to enter the exit manifold. Thus, to avoid high amplitude pressure oscillations in the event of meteoroid puncture of a radiator loop, devices that restrict vapor flow (such as orifices) at the condensing tube exits are desirable with parallel condenser operation. The test section orientation also affected the results since in some cases the liquid head in the exit manifold prevented vapor from entering the exit manifold. The series of simulated condensing-radiator tests was run using a configuration consisting of three tubes of 0.180-inch inside diameter stacked in a vertical plane with the tube axes horizontal. The vertical distance of 6 inches between successive tubes created a pressure differential between the tube exits. In these tests, the total steam flow rate was decreased and temperatures at the tube inlets were recorded. The results indicated the value of low steam flow rate that permits sufficient liquid head in the exit manifold to cause liquid to flow back through the bottom tube. During the testing, pressure oscillations similar to those associated with slugging in other parts of the program were found to be present. No additional instabilities were uncovered. (auth)

2515 (WCAP-2056(Pt.III)) HIGH-TEMPERATURE SUPERCRITICAL PRESSURE WATER LOOP. PART III. FORCED CONVECTION HEAT TRANSFER TO SUPERHEATED STEAM AT HIGH PRESSURE AND HIGH PRANDTL NUMBERS. A. A. Bishop, F. J. Krambeck, and R. O. Sandberg (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). July 1964. Contract AT(30-1)-2948. 101p. Dep.(mn); $4.00(cy), 3(mn) OTS.

Experimental data were obtained over a wide range of parameters for forced-convection heat transfer to saturated and superheated steam. The pressure and Prandtl numbers ranged from 2390 to 3120 psia and 0.9 to 6.0, respectively. Two correlations were obtained for flow through cylindrical tubes; one correlation uses the film temperature as a reference and the second correlation uses the bulk temperature as a reference. The 95% confidence level is ±11.7% and ±12.3%, respectively. Superheated steam data at 1000 to 3000 psia from other sources were found to give a good fit to either correlation. Experimental data were also obtained for steam generated during once-through operation from subcooled water to superheated steam. These data exhibited higher heat transfer coefficients. (auth)

2516 "SWIFT" TEST LOOP PROBES BOILING REGIMES. Can. Nucl. Technol., 21-3(1964).

Extensive instrumentation on an out-of-pile rig is used to evaluate burn-out heat fluxes for experimental fuel geometries. Conditions inside fuel channels of an operating power reactor are simulated by this device, which began operation in December 1963. Each element in the fuel bundle is instrumented with ungrounded 0.020-in. diameter thermocouples. A new test program will be started in 1965. (F.S.A.)

2517 MEASUREMENTS OF HYDRODYNAMIC INSTABILITIES, FLOW OSCILLATIONS AND BURNOUT IN A NATURAL CIRCULATION LOOP. Kurt M. Becker, R. P. Mathisen, O. Eklind, and B. Normann (Aktiebolaget Atomenergi, Stockholm). Nukleonik, 6: 224-33(Sept. 1964).

The hydrodynamic stability and the burnout conditions for flow of boiling water were studied in a natural-circulation loop in the pressure range from 10 to 70 atg. The test section was a round duct of 20 mm inner diameter and 4890 mm heated length. The experimental results showed that within the ranges tested the stability of the flow increases with increasing pressure and increasing throttling before the test section, but decreases with increasing inlet subcooling and increasing throttling after the test section. The measured thresholds of instability compared well with the analytical results by Jahnberg. For an inlet sub-cooling temperature of about 2°C the measured burnout steam qualities were low by a factor of about 1.3 compared to forced-circulation data obtained with the same test section. At higher sub-cooling temperature the discrepancy between data for forced and natural circulation increased, so that at Δt_{sub} = 16°C, the natural-circulation data were low by a factor of about 2.5. However, by applying inlet throttling of the flow the burnout values approached and finally coincided with the forced-circulation data. (auth)

2518 BURNOUT IN STEAM–WATER MIXTURES. John S. Wiley. Power Reactor Technol., 7: 335-53(1964).

A discussion is presented of the significance of the DNB-2 curve on a burnout heat flux vs steam-energy flow plot. It was found that the DNB-2 curve is of little use for design purposes as the information it gives is ambiguous. A review is presented of work on burnout in nonuniformly heated channels, and the methods to treat such burnout are criticized. (D.L.C.)

2519 APPLICATIONS OF BUBNOV-GALERKIN METHOD TO THE THEORY OF HYDROMAGNETIC STABILITY. V. A. Medvedev. Prikl. Mat. i Mekhan., 28: 780-2(July-Aug. 1964). (In Russian)

The Bubnov-Galerkin convergence method was applied to the problem of stability in plane parallel flow of viscous incompressible fluid, which reduces to the Orr-Sommerfeld equation for confined flow between two boundaries, flow with one boundary, and unconfined flow. (R.V.J.)

2520 THE CARRIER-GAS METHOD: MEASURING CONDENSABLE GAS FLOWS WITH A NONCONDENSABLE GAS TRACER. B. A. Fries and D. E. Hull (California Research Corp., Richmond). Trans. Am. Nucl. Soc., 7: 349 (Nov. 1964).

2521 THERMAL CONTACT CONDUCTANCE. R. A. Dean (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 432(Nov. 1964).

2522 UO_2/SHEATH HEAT TRANSFER IN LARGE-DIAMETRICAL-CLEARANCE ELEMENTS IRRADIATED FOR SHORT DURATION. A. S. Bain, J. E. May, and P. A. Morel (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 7: 433(Nov. 1964).

2523 TWO-PHASE PRESSURE GRADIENTS IN THE APPROACH REGION TO CRITICAL FLOW. Amir N. Nahavandi and Richard F. Von Hollen (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 505-6(Nov. 1964).

2524 HIGH-TEMPERATURE GAS HEAT TRANSFER IN TUBES. Mario Dalle-Donne (European Atomic Energy Community, Brussels). Trans. Am. Nucl. Soc., 7: 506-7 (Nov. 1964).

2525 HYDRAULIC STABILITY IN HEATED CHANNELS. A. Carnesale (North Carolina State Coll., Raleigh). Trans. Am. Nucl. Soc., 7: 508-9(Nov. 1964).

Materials Testing

Refer also to abstract 2581.

2526 (HW-SA-3578) RECENT ACCOMPLISHMENTS IN NONDESTRUCTIVE TESTING RESEARCH AT HANFORD LABORATORIES. G. F. Garlick (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 16, 1964. Contract AT(45-1)-1350. 40p. (CONF-784-1). Dep.(mn); $2.00(cy), 1 (mn) OTS.

From Nondestructive Testing Symposium, Argonne, Ill., July 1964.

An account is given of the development of nondestructive

testing techniques at Hanford. These techniques include eddy current tubing testing, eddy current hydride detection in Zircaloy tubes, infrared heat transfer testing, and ultrasonics. (D.L.C.)

2527 HIGH ENERGY RADIOGRAPHY — 1-30 Mev. James H. Bly (High Voltage Engineering Corp., Walnut Creek, Calif.). Mater. Evaluation, 22: 519-32(Nov. 1964).

A survey of the field of radiographic inspection of thick sections, at 1 Mev energy or more, shows this field has become a major branch of radiographic testing. More than a dozen models of x-ray generators are now commercially available in this field, over the range from 1-31 Mev, with outputs up to more than two orders of magnitude greater than can be obtained from radiographic isotope sources, and with smaller spot size. Radiographic technique at 1-30 Mev is straightforward, following the same basic principles as in conventional radiography. Specialized aspects of technique are individually discussed. The well-known 1 and 2 million volt units are supplemented by a wide variety of higher-energy machines, with energy and output ratings to satisfy almost any radiographic need. Some examples are epitomized in tabular form and a brief discussion of possible future developments is appended. (P.C.H.)

Protective Structures

2528 PACKAGING OF AIRBORNE AND SPACEBORNE ELECTRONICS. William H. Pirzl. 40p. (CONF-515-2)

From 2nd Annual National Electronics Packaging and Production Conference, New York, June 1964.

Problems associated with packaging of airborne and spaceborne electronics are reviewed. Included is a discussion of the steps which must be taken in order to withstand applicable environmental conditions. Emphasis is placed on a discussion of the effects of vibration, temperature, radiation, and electromagnetic factors on the packaged units. (auth)

2529 ACCESSORY-CARRYING MEMBER FOR A RADIATION-PROTECTIVE SCREEN. Jean Savouyaud and Jean Vertut (to Commissariat a l'Energie Atomique). U. S. Patent 3,151,244. Sept. 29, 1964. Priority date Jan. 14, 1960, France.

A threaded panel is described which carries a fitting for various manipulative accessories to be used with it. The threads allow it to be easily removed from a shield or interchanged with other devices. The threads are arranged to prevent radiation leakage. (T.R.H.)

GEOLOGY AND MINERALOGY

General

2530 KRYPTON AND XENON IN THE OCEANS. H. Hintenberger (Max-Planck-Institut fur Chemie, Mainz), H. Koenig, L. Schultz, and H. E. Suess. Z. Naturforsch., 19a: 1227-8(Oct. 1964).

Studies were made of xenon and krypton contents of deep ocean water using an isotope dilution method with spikes of mono-isotopic xenon and bi-isotopic krypton. The results for krypton and xenon frequently appeared to exceed the solubilities at the respective temperature. There was a definite indication for supersaturation, which occasionally reached a value 50% above that of the solubility. In water artificially equilibrated with air no indication of supersaturation was observed. (M.C.G.)

Natural Radioactivity and Fallout

2531 (NP-14284) NOUVELLES TECHNIQUES DE PRELEVEMENT ET DE MESURE DE LA RADIOACTIVITE DE L'AIR ET DES PRECIPITATIONS ATMOSPHERIQUES AU NIVEAU DU SOL. (New Techniques of Sampling and of Measurement of the Radioactivity of Air and of Atmospheric Precipitations at Ground Level). C. Jehanno (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). Oct. 1958. 25p. Dep.(mn).

Two devices for the measurement of artificial radioactivity, one in precipitations and the other of radioactivity contained in aerosols when there is no precipitation, were described. The operation and efficiency of the devices were discussed. (J.S.R.)

2532 (UCRL-12124-T) INFORMATION INTEGRATION SYSTEM FOR LRL-L PROGRAM ON MAN-MADE RADIATION IN THE BIOSPHERE. Arthur R. Tamplin and Jason L. Minkler (California. Univ., Livermore. Lawrence Radiation Lab.). [nd]. Contract W-7405-eng-48. 20p. (CONF-765-4). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 2nd Conference on Radioactive Fallout from Nuclear Weapons Tests, Germantown, Md., Nov. 1964.

The mission of this LRL-L program is to develop a comprehensive understanding of the implication of radionuclide releases into the biosphere. The Information Integration Project was established as an integral part of this program. In essence, the purpose of this project is to collect, collate, and analyze the existing world-wide literature on fallout and its transfer through the biosphere into man. Thus, this effort can be described as an attempt to facilitate the solution of the mission problems in the shortest period of time with optimum utilization of personnel. It is intended that the project will accomplish this goal by allowing us to complement rather than duplicate current and past research pertinent to the overall problem. In order to proceed as expeditiously as possible with the literature survey and analysis it was necessary to develop an Information Retrieval system as part of the Information Integration Project. It was concluded that information systems are a problem for the scientist and not for the librarian, and information systems should be manned by scientists who are actively working on the various problems with which the system is concerned. Unless this is so, the system will most likely not be properly problem-oriented (classification will be ambiguous). More important is the consideration that reading and abstracting the literature is a valuable training aid and this training is lost unless it is applied to the problems of science. (auth)

2533 (UCRL-13126) NUCLEAR CLOUD SAMPLING SYSTEM. Final Report. (General Dynamics/Pomona, Calif.). Aug. 15, 1964. For Univ. of California Lawrence Radiation Lab., Livermore. Contract W-7405-eng-48. 326p. Dep.(mn); $7.00(cy), 6(mn) OTS.

The Cloud Sampling Study has resulted in the preliminary design of a vehicle, launch system, and aircraft installation capable of collecting a debris and gas sample from a nuclear cloud with a yield in the range from 500 KT to 10 MT. The vehicle proposed is unguided and will pass 12,500 cubic feet of cloud volume through a filter to collect the isokinetic particulate debris sample and fill a 1.5 cubic foot vacuum bottle with gaseous debris, utilizing aerodynamic ram pressure. The debris sample collection technique incorporated into the proposed design consists of a supersonic conical shock diffuser coupled with a conical ICP 1478 paper filter and a fixed area exit. This vehicle design, when traveling at a velocity between Mach 1.8 and 3.0, collects an isokinetic sample up to an altitude of 100,000 feet. At the time of an atmospheric nuclear device test event, two aircraft each equipped with four Nuclear Cloud Sampling Vehicles can be loitering approximately 50 miles from ground zero. As the cloud reaches full growth, onboard cloud tracking radar can obtain range and azimuth information to be used to navigate to a position directly under the desired sampling location. As this position is reached, the sampling vehicle in its launch canister is released from the carrying aircraft. After the canister has dropped away from the aircraft a deceleration parachute is deployed which, in three seconds, reduces the canister velocity to a point where a cluster of three stabilization parachutes are deployed. These parachutes stabilize the canister in a vertical attitude and the rocket motor is ignited. The vehicle accelerates in a vertical direction and passes through the cloud taking the required debris and gas samples. Near apogee the rocket motor is separated from the sampling payload, and the device is stabilized and its velocity is restricted by use of a descent parachute. After falling back through the cloud and reaching 5000 feet in altitude, a final recovery parachute is deployed and the vehicle impacts in the ocean. Floatation gear and recovery aids then are activated and helicopter recovery is affected. A description of the sampling vehicle including the location of all vehicle components and a launch system are given. The various events in the system operation are then presented in some detail to complete the system description. (D.L.C.)

2534 GROSS BETA RADIOACTIVITY OF LITTORAL SEDIMENTS OF THE LIGURIAN SEA. B. Schreiber (Università, Parma, Italy), L. Pelati, E. Cerrai, and C. Triulzi. Energia Nucl. (Milan), 11: 616-24(Nov. 1964).

In the framework of a research program on coastal sediments, radioactivity measurements were made on cores collected at a depth of 25 to 300 m. Fractions of cores cut along the length were examined for gross beta radioactivity and natural K content from which the activity for ^{40}K was evaluated. The upper layers of each core have the highest specific activity with values ranging between 15.28 and 31.38 cpm/g of dry matter. Lower layers are approximately uniform between 9.30 and 10.71 cpm/g of dry matter. The activity of upper layers of sediments is somewhat dependent on the depth of the bottom and has a maximum value at the 50-m isobath. (auth)

2535 SYMPOSIUM ON [RADIOACTIVITY AND WATER PROTECTION], KARLSRUHE, GERMAN FEDERAL REPUBLIC, JUNE 26-28, 1963. Foederation Europaeischer Gewaesserschutz, Informationsbl., No. 10, 1-86(May 1964).

Nine papers presented at the Symposium on Radioactivity and Water Protection at Karlsruhe are given. Separate abstracts were prepared for each paper. (M.C.G.)

2536 RADIOACTIVITY IN OUR VITAL ENVIRONMENT. O. Jaag (Eidgenossisches Technische Hochschule, Zurich). Foederation Europaeischer Gewaesserschutz,

Informationsbl., No. 10, 16-32(May 1964). (In English, German, and French)

The influence of radioactivity in our environment, its source, its manifestations, and its intensity are discussed. Purification methods for radioactively contaminated water are described. Methods of analyzing water, grass, hay, and soils for radioisotopes are outlined for use in studying the transport of the radioisotopes by water. Radioactivity control activities in Europe, especially Switzerland, are reviewed. Waste disposal is also considered. (M.C.G.)

2537 MONITORING OF THE ATMOSPHERE, PRECIPITATIONS, AND WATERS IN THE EURATOM MEMBER STATES. M. Collet (Communaute Europeenne de l'Energie Atomique, Brussels). Foederation Europaeischer Gewaesserschutz, Informationsbl., No. 10, 47-52(May 1964). (In French)

Control of radioactive contamination of air, water, and soils in the Euratom member states is described. Samplings and tests are made of the radioactive aerosols suspended in the atmosphere and of radioactivity in precipitation, as well as direct measures of external radiation. Measurements are made of both total activity and alpha activity of water. Studies of the radioactivity of water in the Rhine River basin are described. (M.C.G.)

2538 THE LIMITING OF RADIOACTIVE ISOTOPES IN SOIL (UNDERGROUND WATER). F. W. J. van Haaren (Gemeentewaterleidingen, Amsterdam). Foederation Europaeischer Gewaesserschutz, Informationsbl., No. 10, 56-61(May 1964). (In German)

The problem of finding out how ground water is influenced by radioactivity in the soil under normal conditions, by radioactivity in precipitation, and by discharges of concentrated radioactive wastes was considered. Potassium as a factor in the radioactivity of ground water is discussed. Because the radioactive materials in precipitation are chiefly adsorbed and fixed by a top layer of soil, contamination of ground water by these radioactive materials is not very considerable. Several tests were made of water infiltration through different kinds of soils. It was found that the velocity of flow and the presence of adsorbing material alien to the soil are of great importance. Soil contamination by discharge of radioactive wastes is described. (M.C.G.)

2539 DETERMINATION OF PARAMETERS OF ELUTION OF FISSION PRODUCTS FROM THE ATMOSPHERE. K. P. Makhon'ko. Izv. Akad. Nauk SSSR, Ser. Geofiz., No. 9, 1434-9(Sept. 1964). (In Russian)

A suggested formula for relating the specific radioactivity of precipitation to its volume produces results that are in good agreement with the experimental data. Semi-elution of fission products from the atmosphere takes place with the first millimeter of precipitation and depends on the age of the fission products. The mean coefficient of fission product elution by rain drops is $\sim 10^{-5}$ sec^{-1}. The mean constants of radioactive dust coagulation with cloud droplets is $\sim 10^{-6}$ cm^3/sec and coagulation time is ~1 hr. The elution of fresh fission products proceeds at a more vigorous pace than the elution of old fission products. (R.V.J.)

2540 VARIATIONS IN ELEMENTAL CONCENTRATIONS IN THE COLUMBIA RIVER. W. B. Silker (General Electric Co., Richland, Wash.). Limnol. Oceanog., 9: 540-5(Oct. 1964). (HW-SA-3147)

The seasonal changes in concentration of several elements in the Columbia River at Hanford, Washington, were measured during 1962. An annual spring increase in the concentration of arsenic, manganese, copper, and lanthanum was related to the introduction of water from the Spokane River to the Columbia River system, while other elemental concentration changes were ascribed to the relative contribution of the Pend Oreille and Spokane rivers to the Columbia River. Data are presented on the concentration of several elements at various points on the Columbia River upstream from the Hanford project. (auth)

2541 AIR CONCENTRATIONS OF TWELVE RADIONUCLIDES FROM 1962 THROUGH MID-1964. R. W. Perkins, J. M. Nielsen, and C. W. Thomas (General Electric Co., Richland, Wash.). Science, 146: 762-4(Nov. 6, 1964).

New spectrometric techniques for the multidimensional counting of gamma rays permit the direct measurement of twelve radionuclides collected on air filters. Observed concentrations of ^{7}Be, ^{22}Na, ^{54}Mn, ^{60}Co, ^{88}Y, ^{95}Zr–^{95}Nb, ^{106}Ru, ^{124}Sb, ^{125}Sb, ^{134}Cs, ^{137}Cs, and ^{144}Ce during the past $2\frac{1}{2}$ years help to explain the origin and fallout rates of the trace radionuclides in air. (auth)

2542 A THEORETICAL APPROACH TO THE MOVEMENT OF STRONTIUM THROUGH SOILS. M. J. Frissel and P. Poelstra (Inst. for Atomic Science in Agriculture, Wageningen, Netherlands). Soil Sci., 98: 274-7(Oct. 1964).

A theory for the calculation of the leaching efficiency of soil for ^{90}Sr is presented. The difficulties of comparing the calculated and evaluated leaching efficiencies are discussed. Taking these difficulties into account, the order of magnitude of the values calculated is concluded to be quite satisfactory. The differences between theory and experiment increase in the order 0.005 N $CaCl_2$, deionized water, 0.005 N NaCl. The great difference in leaching efficiency between 0.005 N $CaCl_2$ and 0.005 N NaCl is explained theoretically. (auth)

2543 DIFFERENTIAL ENERGY SPECTRA OF THE NUMBER FLUX AS A FUNCTION OF TIME AND ALTITUDE FROM FALLOUT FISSION PRODUCTS. T. W. DeVries (General Dynamics, Fort Worth, Tex.). Trans. Am. Nucl. Soc., 7: 320-1(Nov. 1964).

2544 BULLETIN OF THE ATMOSPHERIC RADIOACTIVITY, NO. 36, JANUARY-MARCH, 1964. Tokyo, The Japan Meteorological Agency, 1964. 72p. (In English and Japanese)

Data are presented on the radioactivity in samples of rain water and dusts collected at various locations throughout Japan during January, February, and March 1964.

Site Survey and Selection

2545 (HASL-148) A PROCEDURE TO DETERMINE THE RELATIVE EXTENT OF REACTOR FISSION PRODUCT RELEASES UNDER VARIOUS METEOROLOGICAL CONDITIONS. Stephen J. Lanes (New York Operations Office. Health and Safety Lab., AEC). July 1964. 56p. Dep.; $3.00(OTS) (cy), 1(mn) OTS.

Several versions of Sutton's equations expressing the atmospheric concentrations, doses, etc., due to a fission product release were programmed for solution by an IBM 1620 computer, as an aid in evaluating the effects of postulated reactor accidents. In addition, each of these equations was solved over a wide range of meteorological parameters and the results graphes, providing an illustration of the effects of changes in one parameter or a combination of them on the solutions. A procedure for the application of these programs and graphs to the review and evaluation of reactor safety problems is presented. (auth)

2546 THE SITE SELECTION OF REACTORS IN REGARD TO THE PROTECTION OF DRINKING WATERS. W. Kumpf (Bundesministerium für Gesundheitswesen, Bad Godesberg, Ger.). Foederation Europaeischer Gewaesserschutz, Informationsbl., No. 10, 33-6(May 1964). (In German)

Among the conditions that determine the choice of site for reactors, requirements for protection of drinking water from radioactive contamination are decisive in the German Federal Republic. Possibilities for a reactor cooling system with continuous water circulation for better water protection are considered. (M.C.G.)

2547 SOME FACTORS OF IMPORTANCE IN EVALUATING SITES FOR NUCLEAR INDUSTRY AS DETERMINED BY A LIMNOLOGICAL STUDY OF THE UPPER OHIO RIVER. M. A. Shapiro, J. F. Ficke, P. V. Morgan, R. D.

Spear, and C. C. Kisiel (Univ. of Pittsburgh). Verhandl. Intern. Ver. Theoret. Angew. Limnol., 15: 299-306(1964).

Factors important in the design and siting of a nuclear industry to keep the levels of radioactivity in the flowing streams below prescribed limits are discussed. At the same same time some of the natural factors that might be utilized by nuclear industry to reduce costly overdesign of waste-treatment facilities are pointed out, and the problems involved in the disposal of radioactive wastes to fresh flowing streams and their watersheds are considered. (auth)

Techniques and Equipment

Refer also to abstract 2473.

2548 (UCRL-7791(Summary)) ELECTRONIC INSTRUMENTATION SYSTEMS FOR NUCLEAR EXPLOSION DIAGNOSTICS. M. McCraven and G. Longerbeam (California, Univ., Livermore. Lawrence Radiation Lab.). May 1964. Contract W-7405-eng-48. 16p. (CONF-776-2). Dep.(mn); $1.00(cy), 1(mn) OTS.

From National Electronics Conference, Chicago, Oct. 1964.

Diagnosis of the phenomena occurring during the detonation of a nuclear explosive requires: radiation detectors that convert many forms of energy (neutrons, gamma, visible light, x rays) into electrical voltage pulses; transmission links for transferring these electrical signals to a safe distance; and oscillograph and digital systems for recording and processing the transmitted data. The extremely short times and tremendous dynamic ranges involved create problems that require unique electronics equipment for their solution. A panoramic view of these equipment developments is presented, and their assimilation into an overall system, the calibration and operation of this system, and future development projects and problems are discussed. (auth)

2549 THE AGE OF THE MGINSKII INTERGLACIAL MARINE STRATUM BY RADIOCARBON DATING. I. E. Starik, Kh. A. Arslanov, and D. B. Malakhovskii. Dokl. Akad. Nauk SSSR, 157: 1369-72(Aug. 21, 1964). (In Russian)

The Mginskii stratum discovered near Leningrad in 1921 has been subjected to detailed studies of spore and pollen, but the age of this stratum is a subject of dispute. Most of the studies assign the Mginskii stratum to the Mikulinskii interglacial period, but others assign it to a more recent era of its own with an age of about 20,000 years. A sample of the stratum was taken and a seashell fraction was isolated from the clay sample. The carbonate material was treated with HCl, and the first 10% of the evolving CO_2 was discarded in order to eliminate the CO_2 from the surface of the sample which might have been contaminated with present-day carbon. A humic acid fraction was also isolated from the clay sample of the stratum. The carbon was converted to benzene (82% yield), and the radiocarbon content was determined by liquid scintillation counting. The age of the humic acid sample was found to be 36,500 years, and the age of the carbonate sample was 47,000 years. Since contamination of the humic acid sample is probable, the age of the Mginskii stratum is assumed to be at least 47,400 years. (TTT)

2550 RADIOACTIVITY WELL LOGGING. Hugh E. Hall, Jr. (to Texaco Inc.). U. S. Patent 3,151,242. Sept. 29, 1964. Filed June 15, 1959.

A bore-hole logging arrangement is described with one source and two detectors. The detectors are spaced so that one indicates hydrogen content and the other, being further away gives a signal which can be interpreted to indicate whether oil or gas is being encountered. The device is not affected by the presence of chlorine. (T.R.H.)

2551 GEOPHYSICAL PROSPECTING FOR UNDERGROUND MINERAL DEPOSITS. Edwin S. Mardock (to Dresser Industries, Inc.). U. S. Patent 3,151,246. Sept. 29, 1964. Filed Apr. 27, 1959.

A method is given for detecting areas of drilling fluid loss and casing leaks in bore holes. It involves the use of drilling fluids of various particle sizes and each size associated with a different radioactive tracer. The sizes are chosen so that a selective leakage will occur, and the tracer will identify the leak. The method also allows study of the nature of the porosity of the stratum or clay layers in a bore hole. (T.R.H.)

HEALTH AND SAFETY

Refer also to abstracts 2190 and 2545.

2552 (HW-SA-3676) THE TREATMENT OF WOUNDS CONTAMINATED WITH PLUTONIUM. J. M. Selby (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 12, 1964. Contract AT(45-1)-1350. 4p. (CONF-652-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Industrial Hygiene Association Pacific Northwest Section Meeting, Richland, Wash., Aug. 1964.

The hazards associated with Pu exposures are reviewed with emphasis on wound contamination. It is pointed out that Pu contamination of wounds is difficult to detect without the aid of a Pu wound counter. Data are reviewed on 46 individuals with potentially contaminated wounds, of which 35 were found contaminated and 22 required incision. Plutonium contamination ranged from a maximum of 1.7 μc to a low of 0.0014 μc. The maximum amount of contamination left in any of the wounds after excision was 0.0064 μc. It is concluded that the excision of minor quantities of Pu from wounds is highly successful. Most of the contaminated wounds occurred in a Pu metal fabrication facility where operations were carried out through glove parts in contained hoods. (C.H.)

2553 (JAERI-1065) EVALUATION OF ABSORBED DOSE FROM AN EXTERNAL β SOURCE. Seiji Fukuda, Hiroshi Kaminaga, and Shoji Izawa (Japan Atomic Energy Research Inst., Tokyo). July 1964. 55p. Dep.(mn). (In Japanese)

The report is primarily concerned with the radiation protection of personnel from the β ray external exposure, and its purpose is to apply the results obtained here to the evaluation of absorbed dose from the external β source on the actual spot where the radiation work is performed. The absorbed dose rate from various sizes of external β sources were calculated as a function of distance from the source. In addition, practical method to obtain the β ray absorbed dose rate using survey instruments which are usually employed in radiation monitoring were examined and conversion factors from a reading of the instruments to the β ray absorbed dose rate were given for various measuring conditions. Particularly, a comparison for β and γ emitters was made about the absorbed dose rate, depth dose and integral dose from the contamination on skin surface, and criterion concerning the allowable limits of the skin surface contamination due to β and γ emitters is discussed. (auth)

2554 (HW-73341) CALIBRATION OF STAPLEX PORTABLE AIR SAMPLERS WITH AN ANEMOMETER. L. F. Kocher (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 6, 1962. Contract AT(45-1)-1350. 8p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A method for calibrating Staplex portable air samplers is described that was found to be sufficiently accurate for samplers with impaction of 4 × 8 in. filter collection heads. Flow characteristics between similar portable air samplers were found to change over a period of time. This would lead to inaccuracies if common or original calibration values were routinely used. It is, therefore, recommended that a program of periodic recalibration of all Staplex portable air samplers be adopted. (auth)

2555 (HW-77345) RECUPLEX INCIDENT, APRIL 7, 1962—EMISSION OF FISSION PRODUCTS FROM THE 291-Z STACK. J. K. Soldat (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 23, 1962. Contract AT(45-1)-1350. 17p. Dep.(mn); $1.00(cy), 1(mn) OTS.

During and after the Recuplex Incident at Hanford on April 7, 1962, filter samples of the 234-5 Building exhaust gases were collected at increased frequencies from the 291-Z stack. The filters were analyzed using gamma spectroscopy. Results of the analyses were evaluated in terms of the emission rates of various fission products from the 291-Z stack. Trajectory of a cloud of radioactive materials discharged from the 291-Z stack at 1100 on April 7, 1962, was calculated. Cloud trajectory and concentration data are given that were used to estimate possible environmental consequences. (auth)

2556 (PNE-301-F) VENTING MEASUREMENTS. W. R. Wray and R. B. Pierce (California. Univ., Livermore. Lawrence Radiation Lab.). Aug. 1964. Project PRE-BUGGY. 82p. Dep.; $3.00(cy), 2(mn) OTS.

A program to compare the amount of a radioactive tracer that escaped and was deposited with the local fallout (vented fraction) from single-charge and multiple-charge detonations is described. A basic series of six single-charge detonations and four multiple-charge detonations of five charges in a row was executed. Each charge contained 1000 pounds of nitromethane with ^{140}La tracer. The experiment consisted of placing known quantities of ^{140}La in the explosive charge, detonating the charge, measuring the distribution of the ^{140}La by sampling techniques (2 ft by 2 ft trays), plotting fallout patterns, integrating the patterns, and determining the vented fraction. The vented fraction of the four row detonations was less than the vented fraction from each of the two single-charge detonations with the same depth of burst as the rows. The final conclusion was that the vented fraction from a multiple-device nuclear detonation would be less than the vented fraction from a single-device nuclear detonation with the same scaled depth of burst. (auth)

2557 DEVELOPING RADIATION PROTECTION STANDARDS. THE ROLE OF THE ATOMIC ENERGY COMMISSION. Forrest Western (U. S. Atomic Energy Commission, Washington, D. C.). Arch. Environ. Health, 9: 654-8(Nov. 1964).

The role of the AEC in developing radiation protection standards is considered from an historical standpoint. Summarily, the AEC has not only contributed to development of current standards of radiation protection; but in the operation of its regulatory program, it has been necessary to develop practices, criteria, and regulations that go beyond the specific recommendations of the NCRP and FRC. (H.M.G.)

2558 NEW GOST [STATE STANDARDS] 8848-63—UNITS OF RADIOACTIVITY AND IONIZING RADIATION. F. M. Karavaev and M. F. Yudin. Izmeritel. Tekhn., No. 6, 51-3(June 1964).

Standard units were established for the following values: activities of isotopes in radioactive source, density of flux of ionizing particles or quanta, radiation intensity, absorbed radiation dose, power of absorbed radiation dose, exposure dose of x and gamma radiation, and power of exposure dose of x and gamma radiation. Taken as the unit of activity of the International System must be one decay per second. Use of the extra system unit of the Curie is also permitted (one Curie = $3.700 \cdot 10^{10}$ decays/second). As for unit of measurement density of flux of any kind of particle or quanta the standard sets one particle of a given species (or quanta) per second per square meter (particle/(second-meter^2) or quanta/(second-meter^2). In abbreviated form the units of density of flux of ionizing particles—alpha-particles/(second-meter^2), beta-particles/(second-meter^2), neutrons/(second-meter^2), gamma-quanta/(second-meter^2), the use of letters of the Greek and Latin alphabets is permitted as commonly accepted. The third variable for which the standard sets units of measurements is the intensity of radiation, here the measurement must be watts per square meter. For measurement of power of absorbed dose of radiation, the unit watt per kilogram is established. Permitted is the use of the extra-system unit decay per second, equal to 0.01 watt/kg. The new standard also sets the unit of measurement of exposure dose of x and gamma radiation as the sum of electrical charges Δq of all ions of the same sign per some mass of air Δm. The unit of exposure

dose of x and gamma radiation in the system is taken as coulombs per kilogram (of air) (coulomb/kg). Also permitted is the use of the extra-system unit of the Roentgen (R), equal to $2.57976 \cdot 10^{-4}$ coulomb/kg (approximately $2.58 \cdot 10^{-4}$ coulomb/kg). A new unit of power of exposure dose of x and gamma radiation in the new standard is set as amperes per kilogram (of air). (TCO)

2559 MEASUREMENT OF ^{90}Sr AND ^{137}Cs IN RADIOACTIVE FALLOUT IN AIR AT HIGH ALTITUDE. Tatsuo Urai (Japan Defense Agency, Tokyo). J. Nucl. Sci. Technol. (Tokyo), 1: 242-5(Oct. 1964).

Measurements of ^{90}Sr and ^{137}Cs in airborne fallout at high altitude were made during the period Nov. 1961–Mar. 1962. Samples were collected in Hokkaido, Chubu, and Kyushu Districts at altitudes of 10 and 12 km. Concentrations of these nuclides in Hokkaido were considerably higher than those in Chubu and Kyushu Districts. Considerable increase of concentrations of both nuclides were observed during the period Jan.–Mar. 1962. (auth)

2560 ARTIFICIAL ATMOSPHERIC RADIOACTIVITY AND HARDLY DETECTABLE EFFECTS ON ITS MEASURING ACCURACY. W. Marquardt (Meteorologische Observatorium Wahnsdorf, Radebeau, Ger.). Kernenergie, 7: 680-5(Sept. 1964). (In German)

The results of atmospheric artificial radioactivity in 1963 are presented. During periods of stopping overground nuclear tests, both long-periodic and short-periodic variations of concentrations may, for the most part, be attributed to dynamic processes in the atmosphere as the parallel results of near-ground ozone measurements evidently indicate. Using the conventional method of filter concentration it was not possible to obtain comparable concentrations on the uplands peaks when weather was foggy. By comparing with the values obtained from neighboring flat stations the man-made activity was found to decrease apparently strongly in fog. The position of the point of measurement also had influence on the results. By wind pick-up of radioactive aerosols already settled on ground, in summer half year higher concentrations were measured at windy flat land stations than at points well screened from wind. Radioactive fallout per week and specific fallout activity are given for the second half year of 1963. The values show a decrease as was expected. (auth)

2561 CONTAINMENT, RADIATION CONTROL, AND SITING. Power Reactor Technol., 7: 370-1(1964).

A British study of the environmental hazard of fission product release from a reactor accident is reviewed; ^{131}I is found to be the most important isotope from the public health viewpoint. The deposition of fission products on surfaces is also discussed. (D.L.C.)

2562 SIMULTANEOUS SIZE AND RADIATION ANALYSIS OF RADIOACTIVE AEROSOLS USING ELECTROSTATIC PRECIPITATION. Gonzalo Fernandez and Charles J. Bridgman (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio). Trans. Am. Nucl. Soc., 7: 336(Nov. 1964).

2563 PRINCIPLES OF RADIATION PROTECTION. G. Eaves. London, Iliffe Books Ltd., 1964. 195p. 42s. Distributed in United States by Gordon and Breach Science Publishers, New York, $8.25.

A general presentation of radiation protection includes discussions of: biology; radiation damage to biological systems; units and quantities; radiation detection and measurement, dosimetry monitoring; an analysis of radiation hazards; maximum permissible levels; an outline of radiation protection methods; remote handling and shielding; containment; the transport of radioactive material; disposal of radioactive wastes; ionizing radiation and low; emergency procedures; reactor hazards; and design and planning for radiation protection. (H.M.G.)

2564 ACCEPTANCE PROCEDURE FOR A NUCLEAR-POWERED SHIP ACCORDING TO TODAY'S LEGISLATION. H. Bianchi (Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt mbH., Hamburg). p.105-8 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

Acceptance procedures for a nuclear-powered research ship are reviewed in the light of current legislation. Liability, reactor safety, and possible changes in the acceptance procedures are discussed. (M.C.G.)

2565 INTERNATIONAL LAW STANDARDIZATION IN THE ACCEPTANCE OF SHIP REACTORS. G. Erler and N. Pelzer (Universität, Göttingen, Ger.). p.109-13 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

The necessity of an international law standardization is discussed. Defects in existing law for ship reactor acceptance are reviewed. Possibilities and form of international cooperation in this are considered. (M.C.G.)

2566 RADIATION PROTECTION RULES AND REGULATIONS AND INDUSTRIAL VIEWPOINTS. R. C. Thorburn (General Electric Co., Pleasanton, Calif.). 9p. (CONF-642-5)

From Health Physics Society, Cincinnati, June 1964.

It is suggested that radiation protection lines, codes, or regulations be made defensible to the public so that they are assured compliance will provide safety, established on basic criteria or primary standards, compatible with actual health and safety programs, and consistent within the atomic energy industry. (auth)

2567 ARRANGEMENT FOR THE SIMULTANEOUS, MUTUAL CONTACTING AND MEASURING OF RADIOACTIVE IMPACTS ON TAPE-TYPE OBJECTS. Julius Bosch (to Frieseke & Hopfner GmbH). German Patent 1,174,914. July 30, 1964. Filed Feb. 16, 1956.

The arrangement for simultaneously monitoring surface contaminations on both sides of a fitter tape consists of a photomultiplier and a slit scintillation crystal. The tape is moved through the slit. The two halves of the crystal are inserted into a light pipe which is interposed between the crystal and photomultiplier. (Gmelin Inst.)

INSTRUMENTATION

General

Refer also to abstracts 2548, 2554, 2927, 3507, and 3715.

2568 (AECL-2061) A DUAL CHANNEL CURRENT REGULATOR FOR USE WITH MAGNETIC LENSES. J. P. D. O'Dacre (Atomic Energy of Canada Ltd., Chalk River, Ont.). Sept. 1964. 18p. Dep.; $0.50(AECL).

A dual-channel current regulator is described. The technique employed is that of a cathode follower current controller with a feedback amplifier. Current change is sensed by means of a resistor in series with the load. The current range of each channel is 0 to 1 amp d-c. A 10% change in the current supply line voltage produces a variation of less than 0.2% of full scale. The average short-term drift (1 hour) is <1%, the long-term average drift (1 week) is <2%. (auth)

2569 (AERE-M-1429) VOLTAGE DIVIDING RESISTORS FOR USE AS WORKING STANDARDS UP TO 30 KILOVOLTS. A. Merrill and A. Downs (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Sept. 1964. 18p. Dep.; $0.70(BIS), 3s. 6d. (HMSO).

The construction, testing, and use of voltage dividers for use up to 30 kv, which are accurate and easily checked, are described. The dividers consist of a number of resistors in series on a suitable mounting constructed of a good insulant and large enough to reduce corona effects to negligible levels. (auth)

2570 (BNL-7546) CURRENT FEEDBACK ELIMINATES ERRORS DUE TO CONTACT VOLTAGE DROPS. E. J. Rogers (Brookhaven National Lab., Upton, N. Y.). [nd]. Contract AT(30-2)-Gen-16. 4p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The effects of build-up of an insulating film on moving contacts used to switch small currents and voltages are shown to be eliminated by using a feedback-controlled transistorized amplifier. The circuit design provides for output voltages of –10 to –20 v in up to 103 steps. (R.E.U.)

2571 (CERN-64-46) A NANOSECOND PULSE GENERATOR OF 200-kV AMPLITUDE. E. Gygi and F. Schneider (European Organization for Nuclear Research, Geneva). Nov. 4, 1964. 29p. Dep.(mn).

The theory and realization of a fast Marx generator are given. A 10-stage type was developed with rise- and fall-times of 2 nsec. Depending on the load, a peak amplitude of about 200 kv was obtained. The delay between application of the trigger pulse and rise of the output pulse is about 10 nsec with a time jitter of 1 nsec maximum. Due to this small time jitter it is possible to connect several generators in parallel. It should be possible to apply the same construction principles to at least a 20-stage generator where one can expect about 400 kV, without increasing appreciably the rise- and fall-times. (auth)

2572 (ELI-85) A GENERAL PURPOSE DIGITAL READ-OUT SYSTEM FOR KICKSORTERS AND SCALERS USING RELAY LOGIC. W. D. Howell and W. R. J. Shorev (Atomic Energy of Canada Ltd., Chalk River, Ont.). July 1964. 92p. (AECL-2041). Dep.; $2.00(AECL).

A general purpose serial digital read-out system using relay logic is described that is capable of recording data at 10 digits per second either in typewritten and/or punched tape format (8 hole IBM or 7 hole Datatron). The system is flexible in choice of programming for automatic control applications and in its data recording facilities. As many as three CDC or Victoreen Analyzers can be sequentially read-out. In addition up to 100 digits of binary coded decimal data from scalers, switches, digital clocks etc., may be recorded. Patch boarding permits typewritten format and word length (maximum 10 digits) to be varied. The system is described, together with some typical assemblies. This is followed by a detailed description of the several units comprising the system and the facilities provided for augmenting the system to meet specific experimental requirements. (auth)

2573 (EUR-2101.e) STUDIES FOR A DATA HANDLING INSTRUMENTATION SYSTEM IN THE CBNM. H. Meyer (European Atomic Energy Community. Central Nuclear Measurements Bureau, Geel, Belgium). 1964. 20p. Dep.(mn).

Some general aspects are given for a data handling system, to be constituted by several flexible standard units as a wired program system, the wiring of which should be adaptable to given needs. Experiments to be conducted are such which need a great length of data words, where data recording on-line with magnetic tape before further handling off-line is of advantage. A storage tube system under study, as integrating memory and display unit for monitoring during recording and for precise viewing of sorted data off-line, is proposed. The characteristics of developed buffer storages, of coding devices, and sorting memories available, and of a magnetic tape handling system under study are also given. (auth)

2574 (NAA-SR-Memo-9841) COHERENCE MEASUREMENTS. R. L. Randall (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Apr. 23, 1964. Contract AT-11-1-GEN-8. 26p. Dep.(mn); $2.00(cy), 1(mn) OTS.

An introduction to frequency response measurements and the mathematical concept of coherence is presented. Electronic instruments are described that are now being used to perform frequency response and coherence measurements of a system or process relating a random-excitation signal and a noise-contaminated response signal. The coherence function represents the fractional portion of a noise-contaminated signal statistically correlated with, or linearly dependent upon, a particular random excitation signal at each frequency. An addition was made to the Gulton Industries Transfer Function Computer to provide an output proportional to coherence. The addition of symmetrical limiters and a temporary re-arrangement of connections converted the gain output to a coherence function but did not affect the phase output. The modified analyzer provides both coherence and phase data versus frequency. The automatic normalizing feature of the limiter circuits eliminates the need for special rescaling during the analysis of most types of test data. This permits the operator to rapidly investigate random test data to determine the frequency regions, if any, where the coherence is high enough to justify detailed analyses. Data that does not display an adequate coherence can then be discarded with a substantial savings of computer time. Coherence measurements are also useful for estimating the statistical accuracy of the final gain and phase measurements. A series of tests using various combinations of the output signals from two random noise generators were conducted to demonstrate the mathematically correct performance of the proposed system for calculating coherence. The results verified that the coherence output of the analyzer was directly proportional to the fraction of an observed response signal from a system under test statistically correlated with an observed random excitation signal at each frequency. (auth)

2575 (NAA-SR-Memo-9883) EXPANSION COMPENSATOR POSITION SWITCH QUALIFICATION TEST REPORT. B. B. Thompson (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). May 5, 1964. Contract AT-11-1-GEN-8. 38p. Dep.(mn); $2.00(cy), 1(mn) OTS.

The qualification testing of expansion compensator position switches manufactured by Micro-Switch for use in

SNAP 10A systems is reported. Four expansion compensator position switches were selected for SNAP 10 A qualification testing. The tests were conducted using NA0403-026 as a guide since this specification was not released at the time the testing was performed. The following qualification tests were performed: performance record; radio interference; vibration and shock; acceleration; thermal cycle in a vacuum; thermal vacuum endurance; and humidity test. Based on the tests performed and the results obtained, the expansion compensator position switches, 10FS-20015, are qualified for the pre-launch, launch, preorbital startup, and startup phases of SNAP 10A operation. They probably would also perform satisfactorily throughout the endurance phase of the flight test but this was not thoroughly demonstrated by the test. (auth)

2576 (NLCO-925) COMPARISON OF METHODS FOR PARTICLE SIZE ANALYSIS. J. A. Freitag (National Lead Co. of Ohio, Cincinnati). Sept. 30, 1964. Contract AT (30-1)-1156. 20p. (CONF-790-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 14th Annual Analytical and Physical Testing Symposium, Cincinnati, Oct. 1964.

A comparison was made of methods for particle size analysis applied to uranium trioxide, uranium tetrafluoride, and magnesium fluoride. The methods studied were the Coulter Counter, sedimentation (in liquid by the Andreasen pipet and in nitrogen by the Micromerograph), and direct measurement from photomicrographs. Satisfactory agreement among the methods was observed for materials containing spherical shaped particles; however, deviations between the Coulter method and sedimentation methods were found for irregular shaped particles. (auth)

2577 (ORNL-P-87) A LOW-TEMPERATURE LIQUID INFRARED ABSORPTION CELL. H. W. Morgan, P. A. Staats, and R. G. Steinhardt (Oak Ridge National Lab., Tenn.). [1962]. Contract W-7405-eng-26. 3p. (CONF-812-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Society for Applied Spectroscopy 3rd National Meeting, Cleveland, Sept.-Oct. 1964.

A low-temperature liquid cell which can be cycled repeatedly through large temperature ranges was constructed by modification of the conventional sealed infrared cell. The liquid cell is formed by a gold foil spacer pressed between two CsBr or AgCl windows, and the cell is sealed by pressure applied through a ring. The cell is cooled by conduction in the base of a Dewar. (D.L.C.)

2578 (RFP-389) WHAT IS THE ACTUAL RESOLUTION OF SHADOWED REPLICAS? C. W. Price and V. K. Grotzky (Dow Chemical Co. Rocky Flats Div., Golden, Colo.). May 5, 1964. Contract AT(29-1)-1106. 36p. (CONF-668-2). Dep.(mn); $2.00(cy), 1(mn) OTS.

From Electron Microscope Society of America 22nd Annual Meeting, Detroit, Oct. 1964.

In electron microscopy, the weak contrast of the replica can be increased by shadow-casting, i.e., vacuum evaporating an electron-dense material obliquely onto the replica. The minimum object size that can be resolved in a shadowed replica is limited by the particle size of the shadowing material. Relative particle sizes of several shadowing materials are given, and some of the factors affecting the particle size are discussed. Finally, the resolution of shadowed replicas is discussed. (D.L.C.)

2579 (UCRL-7610) RESONANT MODES IN THE FABRY-PEROT RESONATOR. G. Hong (California. Univ., Livermore. Lawrence Radiation Lab.). Nov. 13, 1963. Contract W-7405-eng-48. 21p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The fields inside a parallel-disk cavity (Fabry-Perot resonator) excited by an external waveguide through a small aperture are found by an exact method outlined by Rumsey. Conditions for resonance for this cavity are obtained and it is found that experimental data verify these results. (auth)

2580 A SIMPLE VELOCITY DRIVE FOR A MÖSSBAUER EXPERIMENT. J. Olsen and S. Blow (Atomenergikommissionen, Riso, Denmark). Am. J. Phys. 32: 893(Nov. 1964).

A hydrostatic velocity drive is described, consisting of a cylinder in which the in- and out-flow of water can be controlled. The absorber is attached to a cylindrical float in the cylinder. (D.C.W.)

2581 GAMMASCOPY PROBE EQUIPMENT FOR DETECTION OF DEFECTS IN PARTLY FINISHED PRODUCTS DURING ROLLING. R. Huchet. Bull. Inform. A.T.E.N. (Assoc. Tech. Energie Nucl.), No. 48, Suppl., 3-7(Aug. 1964). (In French)

The principle of a gammascope for the detection of defects occurring during rolling and which can be used without stopping or slowing down the rolling process is presented. The conditions under which the equipment is to be used and the characteristics of the gammascope are indicated. (J.S.R.)

2582 RADIO-SNOW GAGES: A REVIEW OF THE LITERATURE. James L. Smith and Donald W. Willen. Isotopes Radiation Technol., 2: No. 1, 41-7(1964).

A literature review is presented of the use of radioisotopes to measure the water content of snow. Both fixed-location and portable snow gages are considered, and instrumentation and calibration aspects of each type are described. Ice-layer detection, geometry effects, and interface effects are discussed. (D.L.C.)

2583 VACUUM VAPOR DEPOSITION OF PLUTONIUM ONTO ALUMINUM. D. L. Coffey and P. A. Tucker (Monsanto Research Corp., Miamisburg, Ohio). J. Vacuum Sci. Technol., 1: 51-3(Nov. -Dec. 1964). (MLM-1223J)

A technique was developed for depositing ^{239}Pu coatings up to 100 μ thick on aluminum sheet. The deposition system was an electron beam vacuum evaporator. Of several crucible materials evaluated, tantalum – 0.1% tungsten was the most satisfactory material for containing the plutonium vapor source. The essential feature of the deposition process was a controlled sequence of substrate temperatures and evaporation rates. The average experimental rates of evaporation of plutonium agreed well with theoretical values, but wetting of the crucible resulted in scattering of the data. The aluminum-plutonium bond area was examined metallographically to determine the factors that influenced the adherence of the deposit. Insufficient reaction as well as excessive reaction between the substrate and the coating resulted in poor adherence. (auth)

2584 NUCLEAR CONTROL TOOLS FOR THE PLYWOOD INDUSTRY. H. R. Evans (Plywood Research Foundation, Tacoma). p.71-2 of "Nuclear Applications to the Wood, Paper, and Pulp Industries Conference." Pullman, Wash., Washington State Univ., 1964.

The use of radiation readout to determine the moisture content in green veneer is discussed. The advantages of being able to sort out the green veneer according to moisture prior to drying are pointed out. It is contended that, despite the findings of a national organization, radiation moisture meters are desirable in the plywood industry. (D.L.C.)

2585 EXPERIMENTAL TECHNIQUES EMPLOYED IN SPACE PHYSICS. John W. Lindner (Space Technology Labs., Redondo Beach, Calif.). p.82-106 of "Space Physics." New York, John Wiley & Sons, 1964.

An outline is given of the instrumentation used aboard satellites and space probes for detecting and measuring magnetic fields, micrometeoroids, plasma, optical spectra, cosmic radiation, and atmospheric properties. (T.F.H.)

2586 DIGITAL DATA HANDLING SYSTEM FOR HIGH ENERGY PHYSICS (Engineering Materials). (Brookhaven National Lab., Upton, N. Y.). (CAPE-1127)

This package contains 13 drawings. For a listing of individual titles see the Engineering Materials List (TID-4100). This data handling system was designed to store a number of bits of information that describes selected nuclear events of interest during the burst of pulsed particle accelerator. During accelerator dead time the stored information is read out and written on a magnetic tape and simultaneously trans-

mitted to a digital computer. The up-down address scaler is a 12-stage binary add or subtract scaler with gated trailing edge speed-up logic around the first six stages to decrease the carry (or borrow) propagation time. The scaler operates from an initially reset condition and adds one count after each word is written in memory. The last word input gating is used to write in memory two words just after a memory readout command is given and just before the memory is actually read out. The write control logic circuit controls the system when events are being written into the memory. The read control limits the data handler when information is being read out of the memory and written on tape and/or transmitted on the data link. The parity generator controls the negative or positive sign number of bits of information of the inverting amplifiers. The recorder output driver is capable of driving the electronics of a Potter compatible tape transport. The data link power driver is used to drive a 50-ohm coaxial cable with a twelve volt swing. Ten of these are built into each system. The input gating uses a 48-type DJ-30 card containing 6 "and" gates per card. Each card corresponds to a bit of the word. The word per event decoder is a conventional binary to decimal converter driven from the outputs of the "drop-in" buffer. The input word commutator drives the input word gates and the commutator is driven by the words per event decoder. The dual transport control permits one data handling system to control two magnetic tape transports. The gate circuits allow an input gate to be opened in the nanosecond region to reduce accidental counts. (F.S.)

2587 DISPOSABLE LIGHT CHAMBER (Engineering Materials). (Oak Ridge National Lab., Tenn.). (CAPE-1152)

This package contains 2 drawings. For a listing of individual titles see the Engineering Materials List (TID-4100). This light chamber is used with the Naval Research Laboratories (NRL) percent penetration meter. It replaces the NRL photometer light chamber with an inexpensive, disposable unit for testing systems that cause instrument contamination. The body is constructed by cementing together two identical epoxy resin castings. The internal dimensions duplicate the unit it is replacing. Glass discs cemented in place seal the ends and contain contamination within the disposable unit. The nontransmitting areas of the glass discs are covered with a nonreflective paper to reduce internal scattering of light. A gas-mask-canister filter located in the exit sample line prevents radioactive particulate matter from reaching the vacuum pump. The canister, disposable light chamber, and sample line tubing are discarded after use. (F.S.)

2588 DIGITAL RADIO ACTIVE PARTICLE DETECTOR AND CONTROL FOR ACCELEROMETER. Robert J. Cohen (to General Precision Inc.). U. S. Patent 3,120,130. Feb. 4, 1964. Filed Mar. 29, 1961.

A sensitive accelerometer is designed for measuring very small accelerations. The accelerometer uses a displaceable inertia element containing a source of radiation such as alpha particles and a fixed detector. The number of emitted particles that reach the detector depends on the distance between the source and the detector, and the output of the detector is digital in form. (D.L.C.)

2589 APPARATUS FOR ANALYZING MATERIAL BY EXCITED X-RAYS. Charles A. Ziegler (to Laboratory for Electronics, Inc.). U. S. Patent 3,146,347. Aug. 25, 1964. Filed Aug. 25, 1961.

An x-ray spectrometer for x-ray fluorescence composition analysis of materials is designed which gives high resolution over a wide range of energies and is capable of distinguishing between two adjacent energy lines in the range 10 to 70 kev. The spectrometer uses an electron beam to bombard the material, and the produced x rays are detected with a NaI crystal or proportional counter. The output pulses are applied to a pulse height discriminator, and the passed pulses are then fed into a readout device. The accelerating voltage of the electron beam is synchronized with the lower gate of the pulse height discriminator, resulting in excellent energy resolution despite the low inherent resolution of the detector itself. (D.L.C.)

2590 PRODUCTIVITY WELL LOGGING. Edmond F. Egan (to Texaco Inc.). U. S. Patent 3,147,375. Sept. 1, 1964. Filed Apr. 21, 1959.

A radiation instrument is designed for productivity well logging, i.e., for locating the zones at which gas, oil, and/or water are entering the well. The instrument uses scattered gamma radiation as a measure of the density of the fluid surrounding the instrument. Examples of the use of the instrument are given. (D.L.C.)

2591 RADIATION CALIPER WELL LOGGING APPARATUS. Hugh E. Hall, Jr. (to Texaco Inc.). U. S. Patent 3,147,376. Sept. 1, 1964. Filed Oct. 14, 1960.

A caliper apparatus is designed which uses radiation to measure the size of the borehole. Scattered gamma radiation is used as a measure of the borehole size, and the influence of the material of adjacent earth formations is neutralized by simultaneously irradiating the borehole with neutrons and detecting the induced gamma radiation along with the scattered gamma radiation. (D.L.C.)

2592 RADIOACTIVITY WELL LOGGING. Hugh E. Hall, Jr. (to Texaco Inc.). U. S. Patent 3,147,378. Sept. 1, 1964. Filed June 15, 1959.

An improved well-logging instrument is designed for combination neutron-gamma logging. In the use of the instrument, separate neutron and gamma sources are passed through the borehole, and radiations resulting from the neutron and gamma irradiations are detected in two zones to provide two signals respectively indicative of the hydrogen content and the density of the earth formations. Thus, hydrocarbon oil and gas in the formations may be distinguished. (D.L.C.)

2593 NUCLEAR BOMB EXPLOSION DETECTING DEVICE. William D. Buckingham, Frank T. Turner, and Robert H. Snider (to Western Union Telegraph Co.). U. S. Patent 3,147,380. Sept. 1, 1964. Filed May 26, 1960.

A device for detecting nuclear explosions is designed which can discriminate between natural or artificial occurrences and nuclear explosions. The device utilizes the thermal radiation from such explosions and is reliable. (D.L.C.)

2594 INDUCTION APPARATUS INCLUDING TEMPERATURE RESPONSIVE MEANS FOR MEASURING THE ELECTRICAL RESISTIVITY OF LIQUID METALS. Leslie Reginald Blake and Anthony Rainsford Eames (to United Kingdom Atomic Energy Authority). U. S. Patent 3,151,293. Sept. 29, 1964. Priority date Sept. 6, 1960, Great Britain.

An induction device for measuring oxide content in liquid metal systems by electrical resistance is described. For temperature compensation in reference voltage comparison an arrangement is provided which consists of a standard resistance (Pt wire) in thermal contact with the liquid metal, and a constantan or manganin coil of low temperature coefficient of resistivity coupled by a transformer. Thus the thermal coefficient of resistivity of the standard can be made to match that of the liquid metal as its temperature changes. (T.R.H.)

2595 TIMING MECHANISM. W. C. Monday (to U. S. Atomic Energy Commission). U. S. Patent 3,156,851. Nov. 10, 1964.

An electro-mechanical timing mechanism capable of effecting multiple switch actuations at or near the end of a predetermined timing period is described. Each element of a pair of contoured trip elements or cams is disposed adjacent to the other and the elements are rotated in opposite directions at different speeds so that a slot in one of the elements and a plurality of progressively deepening steps in the other element are eventually rotated into alignment with each other adjacent to a trip element follower that pivots to provide switch actuation at each of the steps. The timing period is predetermined by initially positioning the slotted element. (AEC)

2596 ION SOURCE FOR A MASS SPECTROMETER. John E. M. O'Meara (to Crosby-Teletronics Corp.). U. S. Patent 3,157,784. Nov. 17, 1964. Filed Dec. 7, 1961.

An ion source geometry is offered which will make

more effective use of the ionization current. The electrodes are arranged so that the electron trajectory and positive ion trajectory are compatible, the positive ions moving toward the filament flow to the analyzer region. An ionization current of a few milliamperes is achieved. (T.R.H.)

2597 LOW VOLTAGE DETONATOR SYSTEM. Robert J. Reithel (to U. S. Atomic Energy Commission). U. S. Patent 3,158,098. Nov. 24, 1964.

A low-voltage detonator is described, comprising a mass of secondary explosive in contact with an electrical bridge wire and confined in a gas-tight container. The explosive is detonated by a voltage source of the order of about 10 connected to the bridge wire by an inductance of the order of 19 μH and a capacitance of the order of 1300 μF connected to the input of the electrical system. (AEC)

Radiation Detection

Refer also to abstracts 2191, 2262, and 3785.

2598 (AED-C-06-10) INSTRUMENTS AND MEASURING TECHNIQUES IN NUCLEAR PHYSICS. Series C: Bibliographies. K. Debertin, comp. (Johann-Wolfgang-Goethe-Universität, Frankfurt am Main. Institut fur Kernphysik). May 1964. 185p. Dep.(mn).

A total of 642 titles is included for methods and instruments used in radiation detection and measurement. Author, patent-number, report-number, and subject indexes are included. The majority of the references have been announced in NSA. (R.E.U).

2599 (BNL-7444) MAN-MACHINE COLLABORATION IN THE ANALYSIS OF BUBBLE CHAMBER PHOTOGRAPHS FOR HIGH-ENERGY PHYSICS. Paul V. C. Hough (Brookhaven National Lab., Upton, N. Y.). Oct. 1963. Contract AT(30-2)-Gen-16. 28p. Dep.(mn); $2.00(cy), 1(mn) OTS.

A high-resolution, high-precision mechanical flying spot digitizer (FSD) operating on-line to an IBM 7094 computer makes available to the computer some 20,000 to 50,000 coordinate pairs describing a bubble chamber picture in a time of a few seconds. The computer is guided by humans in its selection of relevant data—normally be a few rough coordinates recorded in punched cards during a pre-scan, but also by a manual over-ride at the 7094 console in the event of failure in recognition at the time of precision measurement. The system is capable of transition to purely machine recognition as computer programs acquire sufficient subtlety and reliability. The Mark II FSD at Brookhaven is capable of 10 micron resolution and 1 to 2 micron accuracy over a 2×6 in.^{2} area of the photographic negative. Completed systems at Brookhaven and at the University of California in Berkeley are each processing strange-particle events at about the rate of 10 conventional measuring machines, with a further expansion in rate by about an order of magnitude envisioned. (auth)

2600 (BNL-8519) DIGITAL READOUT CIRCUITS FOR WIRE SPARK CHAMBERS. W. A. Higinbotham, J. F. Jacobs, and H. R. Pate (Brookhaven National Lab., Upton, N. Y.). [1964]. Contract AT-30-2-GEN-16. 8p. (CONF-799-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 11th Annual Nuclear Science Symposium, Philadelphia, Oct. 1964.

The wires of wire spark chambers or hodoscope planes are individually threaded through magnetic memory cores which are "set" by the spark currents. Only a small fraction of the wires are struck by the sparks of one event, so that it is practical to generate addresses for those cores which have been "set." Circuits are described that scan the cores sequentially, 32 at a time, generating addresses and transmitting them to a buffer store or to a computer. A certain minimum time, in our case determined by the transit time of signals in cables, is required to scan the cores. A small additional time is required to generate and store each address. Any number of sparks may be handled in one event, and checking features have been incorporated in the system. (auth)

2601 (BNL-8560) THE EFFECT OF THE SECONDARY ELECTRON POPULATION IN AIR ON THE INTERPRETATION AND CALIBRATION OF PERSONNEL MONITORING FILM BADGES. Leigh F. Phillips and Robert J. Champagne (Brookhaven National Lab., Upton, N. Y.). Oct. 15, 1964. Contract AT-30-2-GEN-16. 17p. (CONF-803-4). Dep.(mn); $1.00(cy), 1(mn) OTS.

From International Symposium on the Dosimetry of Irradiations from External Sources, Paris, Nov. 1964.

An important aspect of film badge calibration and interpretation is the extreme sensitivity of the open window portion of the film badge to changes in the secondary electron population in air. The variation of the electron population, resulting from environmental scatter conditions, has often caused puzzling contradictions in the interpretation of personnel exposures. This is particularly important in the estimation of the beta or surface dose, in the presence of gamma radiation exposure. To study these effects, film badge exposures have been made under various shadow and scattering conditions by utilizing collimators, partial shielding, and high Z scattering materials. Cobalt-60, cesium-137 and radium-226 gamma ray sources were used to compare the effects of a wide range in secondary electron energy spectra. Several types of film badges and a variable wall ionization chamber were also used. These results are compared with free air calibrations and exposures made in actual work areas at the BNL reactors and high energy accelerators. The significance of these effects is best demonstrated with exposures of high energy cobalt-60 gamma radiation. In this case, the ratio of the optical density of the film under the open window to that under a one mm cadmium filter may vary from greater than 2.0 in a free air condition to less than 0.7 in narrow collimated beams. The lower energy cesium-137 gamma radiation produces secondary electrons which cause a less significant variation in response. Similar dependence of the response of thin wall ionization chambers on the degree of collimation has also been demonstrated. (auth)

2602 (CRGP-1182) LOW-NOISE, CHARGE-SENSITIVE, VACUUM TUBE PREAMPLIFIER FOR SEMICONDUCTOR DETECTORS. A. J. Tavendale (Atomic Energy of Canada Ltd., Chalk River, Ont.). Sept. 1964. 11p. (AECL-2071). Dep.; $0.50(AECL).

The design and performance of a low-noise, charge-sensitive vacuum tube preamplifier for semiconductor detectors are described. The preamplifier has a noise figure of 1.8 kev FWHM-germanium equivalent or 270 rms electron-hole pairs at zero load capacitance. The slope of the noise versus input load capacitance characteristic is 0.04 kev FWHM-germanium equivalent per picofarad. (auth)

2603 (K-1618) CRITICALITY-ACCIDENT DOSIMETRY STUDIES. J. C. Bailey (Oak Ridge Gaseous Diffusion Plant, Tenn.). Oct. 15, 1964. Contract W-7405-eng-26. 194p. Dep.; $5.00(cy), 6(mn) OTS.

Experiments were carried out to (1) explore possibilities for developing a less expensive device than the Hurst threshold detector unit (TDU) for monitoring possible accidental critical reactions in uranium-processing facilities, (2) to study the precision and accuracy of the TDU, and (3) to evaluate the ORNL film badge in mixed neutron-gamma radiation fields. TDU dosimeters, film badges, a number of materials which might be used as dosimeter components, and phantoms filled with saline solution were exposed to radiation from the Tower Shielding Reactor at the Oak Ridge National Laboratory in a series of experiments in 1961. The experimental arrangements were such that a number of shielding and spectral conditions were obtained. Additional TDU data obtained by other experimenters on other critical assemblies were included in the analyses. Analytical studies included correlations between responses of the various TDU components and between the responses of the gamma detectors and the neutron detectors of the film badge. In addition, the constants used in interpreting TDU data were re-evaluated to account for the effects of resonance-energy neutrons more fully than do the TDU data interpretation

methods used previously. Empirical equations relating the responses of TDU plutonium and neptunium foils to the measurements obtained with the sulfur, uranium, and cadmium-covered gold foils of the TDU were developed. For a number of critical assemblies varying from uranium metal to a highly moderated critical solution, and for a wide variety of shielding and scattering conditions, these expressions represented the experimental plutonium and neptunium responses with accuracies of ±18% and ±17%, respectively, at the 95% confidence level. Further, over the fairly wide range of spectra achieved in the present experiments the 4½-hour half-life activity induced in indium could be used to yield data directly comparable to that given by the TDU uranium foil. The longer lived activity and greater sensitivity of indium offer advantages over uranium-238 as a fast-neutron detector. Thus, the development of a device cheaper than the TDU which will yield data for comparable neutron energy ranges appears feasible. Coefficients were established for the responses of film and phosphate glass rods to thermal, resonance, and fast neutrons, and for neutron-capture gamma emission from the body of an individual wearing the badge. The maximum error in the gamma dose estimated from film badges not shielded from the reactor by the body of the phantom was a 27% underestimate, whereas uncorrected dose estimates were high by as much as 250%. (auth)

2604 (LA-DC-6500) TRANSIENT RESPONSE OF SOLID-STATE DETECTORS. A. Hemmendinger, M. G. Silbert, and A. Moat (Los Alamos Scientific Lab., N. Mex.). [1964]. Contract W-7405-eng-36. 8p. (CONF-799-3). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 11th Annual Nuclear Science Symposium, Philadelphia, Oct. 1964.

The response of a solid state detector to large bursts of ionizing particles was investigated for the purpose of determining detectors suitable for recording accurately the sizes and shapes of rapidly changing ionizing flux. Basic design details for a gamma detector with response proportional to the incident energy flux are given. (auth)

2605 (MLM-1197) DETERMINATION OF COINCIDENCE CORRECTIONS IN A PROPORTIONAL COUNTER. I. DOUBLE SOURCE METHODS. H. W. Kirby (Mound Lab., Miamisburg, Ohio). May 13, 1964. Contract AT(33-1)-Gen-53. 17p. Dep.; $1.00(cy), 1(mn) OTS.

Methods for determining the resolution time of a counting system, with specific reference to precise alpha counting in a proportional counter, are reviewed. The multiple-source method is compared with the simple double-source method and is found to offer no practical advantage and to introduce some serious disadvantages. An exact solution is derived for the double-source method, which eliminates the computational error inherent in the usual approximation employed for determining the resolution time. (auth)

2606 (RFP-439) LIQUID ALPHA-GAMMA COUNTER FOR THE SIMULTANEOUS DETERMINATION OF PLUTONIUM AND AMERICIUM. C. R. Forrey (Dow Chemical Co. Rocky Flats Div., Golden, Colo.). [nd]. Contract AT(29-1)-1106. 19p. (CONF-721-5). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 8th Conference on Analytical Chemistry in Nuclear Technology, Gatlinburg, Tenn., Oct. 1964.

The design, operation, and limitations are discussed. (J.R.D.)

2607 (TID-21291) PROCUREMENT SPECIFICATION FOR A LOGARITHMIC RADIATION MONITOR. Gerald L. Erickson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 5, 1964. Revision No. 3. Contract AT(45-1)-1350. 36p. (HWS-5991). Dep.(mn); $2.00(cy), 1(mn) OTS.

The specification describes the design requirements for a Logarithmic Radiation Monitor which consists of an integrally packaged six-decade logarithmic picoammeter, intermediate level limit detector, high level limit detector, and an ionization chamber polarization power supply. A detailed compliance test and general acceptance test is given. (D.L.C.)

2608 (UCRL-12151) DEVELOPMENT OF A LiF DOSIMETRIC MATERIAL. Donald Jones, James Gaskill, Alice Burt, and Seymour Block (California. Univ., Livermore. Lawrence Radiation Lab.). Oct. 15, 1964. Contract W-7405-eng-48. 28p. (CONF-803-1). Dep.(mn); $2.00(cy), 1(mn) OTS.

From International Symposium on the Dosimetry of Irradiation from External Sources, Paris, Nov. 1964.

Preliminary results are reported of work carried out in an attempt to develop a producible, inexpensive LiF crystal with better thermoluminescence properties than commercially available material. LiF doped with various cations was studied, and the diffusion, melt and slow-cool, and single-crystal growth methods were used for fabricating the dosimetric material. Thermoluminescence data for the experimental materials are tabulated. (D.L.C.)

2609 IONISATION CHAMBERS FOR THE MEASUREMENT OF GASEOUS BETA-EMITTERS. I. P. Sinclair and J. R. Greening (Edinburgh Univ. and Royal Infirmary, Edinburgh). Brit. J. Radiol., 37: 870-2(Nov. 1964).

Designs for two types of ionization chambers used for measuring gaseous beta emitters, the vacuum-tight chamber and the continuous flow chamber, are described. (H.M.G.)

2610 A POCKET RADIATION MONITOR. N. M. Procter (Western General Hospital, Edinburgh) and E. Leask. Brit. J. Radiol., 37: 872-4(Nov. 1964).

A device for warning radium ward nursing staff when they are in a relatively high radiation field is described. Current miniaturization techniques made it possible to build a small sophisticated instrument giving a warning in the form of an intermittent note of about 2 kc/sec, the duration of which increases with rise in radiation intensity. (H.M.G.)

2611 NUCLEAR ENERGY AND REACTOR ENGINEERING. Helmut Kotschi and Elmar Schruefer. Elektrotech. Z., 16: 424-7(July 3, 1964). (In German)

Developments in nuclear power plants and reactors are reviewed. Instruments for measuring radiation and various components of these instruments are discussed. (M.C.G.)

2612 COUNTING STATISTICS AND DEAD-TIME LOSSES. PART 2. I. De Lotto (CNR and CISE, Segrate, Italy), P. F. Manfredi, and P. Principi. Energia Nucl. (Milan), 11: 599-611(Nov. 1964).

The output of cascades of two counters with finite resolving time, connected directly or by a scaler, is investigated. Both paralyzable and nonparalyzable counters are considered. For the case of stationary regime, asymptotic expressions for the counting losses are given and plotted. (D.C.W.)

2613 ON THE POSSIBILITY TO MEASURE DRIFT VELOCITIES IN SPARK FIELDS BY MEANS OF THE LIGHT CHAMBER. G. Cavalleri (CISE, Segrate, Italy). Energia Nucl. (Milan), 11: 630(Nov. 1964).

A method is proposed for measuring drift velocities for very high E/p, where E is the electric field in v/cm and p is the pressure in mm Hg, using the light chamber and Townsend's first coefficient in spark fields. (D.C.W.)

2614 PRECISE DETERMINATION OF DECAY RATES OF RADIOACTIVE PREPARATIONS BY THE COINCIDENCE METHOD USING SCINTILLATION COUNTERS. R. Frosch, P. Huber, and F. Widder (Universität, Basel). Helv. Phys. Acta, 37: 409-28(1964). (In German)

The measurement of radioactive decay rates by means of a coincidence apparatus with scintillation counters only is discussed. Such an apparatus is specially suited for the γ-γ coincidence method, but measurements with the β-γ and α-γ coincidence method are also feasible. The accuracy of the source strength determination is improved as follows: The effect that two coinciding particles may generate pulses in the same scintillator is taken into account by a "sum-pulse" correction factor. Formulas for this factor in the β-γ and γ-γ method are derived. Experimental and theo-

retical ways of determining the factor are discussed. Measurements of ^{198}Au with the β-γ method and ^{60}Co with the γ-γ method are described as examples. To test the precision, samples of ^{60}Co calibrated using the $4\pi\beta$-γ method were remeasured with the γ-γ method. The results agree within the experimental errors, which in the most favorable case amounted to 0.2% for both methods. (auth)

2615 SOME PROPERTIES OF AIR SPARK CHAMBERS. P. K. F. Grieder (Universitat, Bern). Helv. Phys. Acta, 37: 469-74(1964).

The ionization discrimination ability of air spark chambers having particular geometries was investigated. It was found that good discrimination can be obtained with a single gas device between strong and minimum ionizing particles, while the discrimination between intermediate and minimum ionizing particles is poor. The rod and plate type chamber is capable of producing reliably simultaneous multiple sparks for simultaneous multiple events, provided that the pulse voltage is fed to each rod through a separation resistor and that the events do not occur along the same rod. (auth)

2616 COSMIC-RAY REGISTRATION AT THE NOVOLAZAREVSK STATION. P. Khaloupka. Inform. Byul. Sov. Antarki. Ekspeditsii, No. 41, 45-6(1963). (In Russian)

A cosmic ray recording device consisting of two wide-angle telescope counters with 160 × 160 cm effective area and located 22 cm from each other were installed at the Novolazarev station in June 1962. The device is capable of recording 9000 pulses/min. The resolving power for double coincidence is 2 μ sec. (R.V.J.)

2617 RECENT DEVELOPMENTS IN COUNTING METHODS. Isotopes Radiation Technol., 2: No. 1, 34-41 (1964).

The development of flexible-tube Geiger counters is described. Construction details are given, and the performance of the counters is discussed. The synthesis of resins having both ion-exchange and scintillation properties is described along with their counting efficiency and physicochemical properties. Practical and potential applications of these resins are considered. (D.L.C.)

2618 OPERATION OF A LOW-PRESSURE HELIUM-FILLED DIFFUSION CLOUD CHAMBER. S. Barkan (Univ. of Istanbul). Istanbul Univ., Fen Fak. Mecmuasi, Seri C, 29: 1-12(Jan.-Apr. 1964). (In French)

The possibility of operating a helium-filled diffusion cloud chamber at pressures below 4 atm was investigated. Temperature and electric field effects were studied at pressures of 1 to 4 atm, and the optimum operating conditions were determined. Satisfactory operation of the chamber was obtained even for pressures of 5 to 80 cm of Hg under carefully controlled conditions. (D.C.W.)

2619 IMPROVEMENTS IN INDICATOR SYSTEMS FOR TRANSISTORIZED FAST SCALING CIRCUITS. S. Sinman (Univ. of Istanbul). Istanbul Univ., Fen Fak. Mecmuasi, Seri C, 29: 40-62(Jan.-Apr. 1964).

Three systems for reading out binary information in n numerical form, using tuning indicator tubes, gas-filled cold-cathode numerical indicator tubes, and cathode-ray tubes, were investigated. (D.C.W.)

2620 ON THE TIME RESOLUTION OF CHARGED PARTICLE SEMICONDUCTOR DETECTORS. I. A. Baranov, M. V. Blinov, and N. M. Kazarinov. Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1257-8(July 1964). (In Russian)

2621 STUDIES ON RADIATION DOSIMETRY BY A SOLID COLOR CHANGING SUBSTANCE (SOLID COLOR RADIATION DOSIMETRY). Masaru Wakabayashi, Goro Irie, Shigeru Shibata, Sueo Kawanishi, Kazuo Suzaki, Tadashi Sugawara, Emiko Yamada, Naoya Iwasaki, Hideo Mitsuhashi, and Osami Oyama (Hokkaido Univ., Sapporo). J. Radiation Res. (Japan), 4: 68-79(June, Sept., Dec., 1963).

A study on the solid chemical dosimeter was made to improve the sensitivity to x ray and the stability to ultraviolet. According to the results obtained with gelatin, cellulose, plastic, paraffin, and fat, the best material as a base was paraffin. The small amount of vaseline was added to paraffin to prevent crack and flake formation. The results of the screening of about 100 dyes showed that methyl yellow was the best dye of those to detect the effect of x irradiation in a chloroform-paraffin system. Dithizone was sensitive dye in carbon tetrachloride-paraffin system. Many kinds of organic and inorganic compounds were blended into the chloroform-paraffin-vaseline system to sensitize to ionizing radiation and stabilize to uv. Para-hydroxyazobenzene was most effective as a sensitizer and stabilizer. Several halogenated hydrocarbons were mixed into the methyl yellow-paraffin-vaseline system to check the degree of color change produced by x ray and it was found that chloroform was the best for the methyl yellow system. From these experiments, a practical dosimeter was made by mixing of methyl yellow, p-hydroxyazobenzene, paraffin, and vaseline. Three methods using electric, optical, and pH meters were tried in measuring the amount of chemical products in the dosimeter, but the pH meter was most applicable. The amount of acid produced by x rays was directly proportional to the exposure dose to 5000 R. The multicolor changes proportional to dose were made by the combination of dithizone and methyl yellow added to carbon tetrachloride-chloroform. (auth)

2622 THE RESOLVING POWER OF LITHIUM-GLASS SCINTILLATORS. E. Fritzsch and J. Kloeber (Physikalische Institut der Bergakademie, Freiberg i. B.). Kernenergie, 7: 674-7(Sept. 1964). (In German)

The resolving power of the lithium silicate glass Neu G 1 was determined as a function of the thickness of the light pipe for disk-shaped scintillators. The effects of focusing and of the dynode 1/dynode 2 potential were studied for the photomultipliers of the types M 12 FS 35 and S 12 FS 60. The optimium light pipe thickness depends on diameter and thickness of the scintillating disk. For the multiplier S 12 FS 60, the influence of focusing on the resolving power increases with increasing diameter of the scintillator. By means of an aluminum reflector a resolving power of 20 was reached for a scintillator of 50 mm in diameter, a light pipe 15 mm thick, and a glass 5 mm thick. When using a MgO reflector, the value even reached 17%. (auth)

2623 THE FIRST LIQUID IONIZATION CHAMBER: THE "SILISTOR." A. Bérard. Mesures Controle Ind., 23: 227-8(1963). (In French)

The use of the silistor, liquid excitable elements capable of furnishing a response in the form of electrical currents after excitation by pulses, for the detection of radiations is proposed. The silistor has a rest voltage of 47 mv and a reversible polarity that depends on the direction of the exterior excitation. The modification of the input stage to use the silistor is given. (J.S.R.)

2624 A NEUTRON REM COUNTER. I. Oe. Andersson and J. Braun (Aktiebolaget Atomenergi, Studsvik, Sweden). Nukleonik, 6: 237-41(Sept. 1964).

A neutron detector is described, which measures the neutron dose rate in rem/hr independently of the energy of the neutrons from thermal to 15 Mev. The detector consists of a BF_3 proportional counter surrounded by a shield made of polyethylene and boron plastic that gives the appropriate amount of moderation and absorption to the impinging neutrons to obtain rem response. Two different versions were developed. One model can utilize standard BF_3 counters and is suitable for use in installed monitors around reactors and accelerators and the other model is designed for use in a portable survey instrument. The neutron rem counter for portable instruments has a sensitivity of 2.4 cps/mrem/hr and is essentially nondirectional in response. With correct bias setting the counter is insensitive to gamma exposure up to 200 R/hr from ^{60}Co. (auth)

2625 CONSTRUCTION AND INVESTIGATION OF THE PROPERTIES OF A SPARK CHAMBER. P. Mokrý (Inst. of Physics, Prague) and W. Wójcik. Nukleonika, 9: 421-4(1964).

The properties of two similar spark chambers with foil and massive electrodes, respectively, were investigated. The results are summarized. (D.C.W.)

2626 IONIZATION CHAMBER SYSTEM WITH EARTHED WALL FOR INTRA-CAVITARY USE. Goeran Svensson and Bengt Bjaerngard (Univ. of Lund, Sweden). Phys. Med. Biol., 9: 465-7(Oct. 1964).

When constructing cable-connected ionization chambers, especially small ones, it is a practical advantage to place the battery in the lead between the central electrode of the chamber and the input of the measuring instrument. The outer electrode can then be earthed. The practical use of such an ionization chamber is described. (auth)

2627 A DIGITAL DOSIMETER AND CONTROLLER. G. P. Naylor (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Phys. Med. Biol., 9: 469-76(Oct. 1964).

An integrating dosimeter system is described which terminates an x ray treatment exposure after a pre-set dose of radiation, as measured by an ionization chamber placed between the tube and the patient. Details of the construction of an aluminium ionization chamber, which has proved more reliable than chambers made of Perspex, are given. The integrating process, including the discharge, is carried out electronically using a cold cathode trigger tube, and the mechanical counting is carried out by a chain of single digit counters which have previously been pre-set by means of electrical push-buttons to a figure calculated from the prescribed dose. The counters count down to zero and then terminate the exposure. (auth)

2628 NEUTRON DEPTH DOSE MEASUREMENTS IN A TISSUE-EQUIVALENT PHANTOM FOR AN INCIDENT Pu–Be SPECTRUM. R. C. Lawson and D. E. Watt (United Kingdom Atomic Energy Authority, Chapelcross, Annan, Scotland). Phys. Med. Biol., 9: 487-503(Oct. 1964).

An elliptically shaped polythene phantom, filled with tissue-equivalent material, was exposed to collimated beams of fast neutrons from a Pu–Be source. Absorbed doses were measured at depth in the phantom for beams incident on both the major and minor axes. A Bragg-Gray type detector, made from plastic phosphor and polyvinyltoluene sheet, was used to measure the proton recoil absorbed dose from the fast neutrons and a LiI(Eu) crystal to detect the thermal neutrons. Various correction factors to account for thermal neutron flux depression and self shielding from the crystal, neutron attenuation by the probe, etc., are discussed in detail. The absorbed dose at depth in tissue due to the $^{14}N(n,p)^{14}C$, $^{1}H(n,\gamma)^{2}D$ reactions were derived from the corrected fluxes. The experimental doses are compared with the theoretical values of Snyder and Neufeld for broad beam irradiations, and with various other published results. Quality factors are determined and dose equivalents calculated. (auth)

2629 A STUDY OF 4 Mev TRANSVERSE DATA AND ASSOCIATED METHODS OF CONSTRUCTING ISODOSE CURVES. J. S. Orr, Jean Laurie, and Sheila Wakerley (Western Regional Hospital Board, Glasgow). Phys. Med. Biol., 9: 505-15(Oct. 1964).

4 Mev transverse data, the depth doses at points on a line perpendicular to the central axis and parallel to one edge of the field, are examined for a ^{60}Co γ beam. Their dependence on major axis, primary beam, focus-surface distance, depth, and energy is considered. Methods of constructing isodose curves from transverse data are described and explained. By using the results of the study, full value may be obtained from a minimum of experimental data. The data discussed were derived from measurements made in a large water tank with a probe ionization chamber remotely driven in two perpendicular directions. (auth)

2630 ENERGY FOR ELECTRON-HOLE PAIR GENERATION IN SILICON BY ELECTRONS AND α PARTICLES. C. Bussolati (Istituto di Fisica del Politecnico, Milan), A. Fiorentini, and G. Fabri. Phys. Rev., 136: A1756-8 (Dec. 14, 1964).

The difference of response of Si semiconductor detectors to α particles and electrons was tested. The mean energy required for electron-hole pair generation by electrons was found to be different from that for α particles. These values are, respectively, $\epsilon_\infty = 3.79 \pm 0.01$ and $\epsilon_\infty = 3.61 \pm 0.01$ at a temperature of 300°K for electrons (365 kev) and α's (5.477 Mev). (auth)

2631 AUTOMATIC SCANNING AND MEASURING OF BUBBLE-CHAMBER FILM. A. H. Rosenfeld (Univ. of California, Berkeley). Trans. Am. Nucl. Soc., 7: 234-5 (Nov. 1964).

2632 THE CADMIUM PHOTOACTIVATION DOSIMETER. C. D. Wagner (Shell Development Co., Emeryville, Calif.). Trans. Am. Nucl. Soc., 7: 318(Nov. 1964).

2633 THE NITROUS OXIDE DOSIMETER—EFFECT OF CELL DIAMETER ON THE NITROGEN YIELD. Don A. Kubose (Stanford Research Inst., Menlo Park, Calif.). Trans. Am. Nucl. Soc., 7: 318-19(Nov. 1964).

2634 TECHNIQUE FOR OPTIMIZING THE COMPOSITION OF REGENERATING NEUTRON-FLUX MONITORS. W. L. Bunch (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 319(Nov. 1964).

2635 INFORMATION RETRIEVAL FROM PHOTOGRAPHIC FILMS BY NEUTRON ACTIVATION. M. W. Kahng, S. Lakshmanan, and D. Duffey (Univ. of Maryland, College Park). Trans. Am. Nucl. Soc., 7: 331(Nov. 1964).

2636 AUTOMATIC QUENCH DETERMINATION IN LIQUID SCINTILLATION COUNTING BY EXTERNAL STANDARDIZATION. Ariel G. Schrodt, James Gibbs, and Robert Cavanaugh (Packard Instrument Co., Downers Grove, Ill.). Trans. Am. Nucl. Soc., 7: 339-40(Nov. 1964).

2637 A BETA DETECTOR UTILIZING PLASTIC SCINTILLATION FIBERS. G. Hardie, J. J. Ezop, and C. C. Preston (Illinois Inst. of Tech., Chicago). Trans. Am. Nucl. Soc., 7: 340-1(Nov. 1964).

2638 THEORY AND METHODS OF CORRECTION FOR RESOLUTION LOSSES OF COUNTING EQUIPMENT. K. E. Plumlee (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 341(Nov. 1964).

2639 RELATIVE EFFICIENCIES OF SOME NEW LIQUID SCINTILLATION SOLUTES. Elizabeth T. Bush and David Hansen (Nuclear-Chicago Corp., Des Plaines, Ill.). Trans. Am. Nucl. Soc., 7: 339(Nov. 1964).

2640 A RAPID SCREENING TECHNIQUE USING SCINTILLATING ION EXCHANGE RESINS. A. H. Heimbuch, H. Gee, and W. J. Schwarz (Tracerlab, Inc., Richmond, Calif.). Trans. Am. Nucl. Soc., 7: 349-50(Nov. 1964).

2641 DIGITAL-COMPUTER ANALYSIS OF BETA-RAY SPECTRA. John H. Nodine, Donald Ware, and Joseph M. Platt (Hahnemann Medical Coll., Philadelphia). Trans. Am. Nucl. Soc., 7: 351(Nov. 1964).

2642 METHODS OF FAST-NEUTRON SPECTROSCOPY FOR REACTOR SHIELDING. F. C. Maienschein (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 368(Nov. 1964).

2643 FAST NEUTRON SPECTROSCOPY BY 4π RECOIL PROPORTIONAL COUNTING. E. F. Bennett (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 369-70(Nov. 1964).

2644 THRESHOLD FOIL SPECTROSCOPY AT THE MITR MEDICAL FACILITY. R. A. Rydin and G. L. Brownell (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 7: 370-1(Nov. 1964).

2645 LEAST SQUARE MATRIX METHOD FOR ANALYZING NEUTRON SPECTRA. H. M. Epstein, B. P. Fairand, and B. L. Schrock (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nucl. Soc., 7: 371-2(Nov. 1964).

2646 HELIUM-3 FAST NEUTRON SPECTROMETER WITH EXTENDED ENERGY RANGE. A. Sayres (Columbia

Univ., New York). Trans. Am. Nucl. Soc., 7: 372-3(Nov. 1964).

2647 RECENT DEVELOPMENTS IN THE PROTON-RECOIL SCINTILLATION NEUTRON SPECTROMETER. W. R. Burrus and V. V. Verbinski (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 373-4(Nov. 1964).

2648 RESPONSE FUNCTIONS OF AN ORGANIC SCINTILLATOR TO FAST NEUTRONS. V. V. Verbinski, J. C. Courtney, W. R. Burrus, T. A. Love, and J. G. Sullivan (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 374(Nov. 1964).

2649 THE DESIGN BASIS FOR PINHOLE GAMMA-RAY CAMERAS. M. A. Greenfield (Univ. of California, Los Angeles) and R. L. Koontz. Trans. Am. Nucl. Soc., 7: 473-4 (Nov. 1964).

2650 A SOVIET APPARATUS FOR THE INVESTIGATION OF THE INTENSITY OF COSMIC RAYS. Wojskowy Przeglad Lotniczy, No. 4, 91(1964).

Soviet sputniks and various spacecraft frequently contain special apparatus for the investigation of cosmic-ray intensities. The third sputnik and the first three spacecraft contained Cherenkov counters to determine the frequencies of Li, Be, and B nuclei in space. The spacecraft contained more complicated apparatus that broadcast the information obtained to earth where the data were analyzed. The purpose was to assure crew safety in flight and to obtain data for future reference. (OTS)

2651 THE THEORY AND PRACTICE OF SCINTILLATION COUNTING. J. B. Birks. A Pergamon Press Book. International Series of Monographs on Electronics and Instrumentation. Volume 27. New York, The Macmillan Company, 1964. 681p. $17.50.

A survey is given of scintillation processes in organic materials (crystals, liquids, plastics, and other materials), inorganic crystals, and gases. The survey also covers the detection of scintillations and the applications of the various types of phosphors in radiation detection instruments. (T.F.H.)

2652 LOW-BACKGROUND HIGH-EFFICIENCY GEIGER-MÜLLER COUNTER. Technical Reports Series No. 33. (International Atomic Energy Agency, Vienna). 1964. 31p. $1.00; S 21,-; 6/-stg., F.Fr.4,-; DM 3,20 (IAEA).

The design and performance of a low-background (0.2 cpm) G-M flow counter with high efficiency (50%) for pC samples (^{90}Y) in a carrier (30-mg yttrium oxalate) are described. The anticoincidence umbrella consists of a single G-M counter (Philips 18518). (R.E.U.)

2653 PRESENT AND FUTURE NEEDS OF DOSIMETRY. Harald H. Rossi (Columbia Univ., New York). 7p. (CONF-642-6)

From Health Physics Society, Cincinnati, June 1964.

The successful development of radiation dosimetry requires not only a knowledge of practical problems but also an understanding of the various activities for which dosimetry is required. A brief review is presented that is primarily concerned with those basic problems in medical radiology, radiation protection, and radiobiology in which dosimetry can make significant contributions. (auth)

2654 ALPHA OR BETA-GAMMA RADIATION MONITOR /Q-2091/ (Engineering Materials). (Oak Ridge National Lab., Tenn.). (CAPE-1178)

This package contains 5 drawings. For a listing of individual titles see the Engineering Materials List (TID-4100). The vacuum-tube, general-purpose monitor is used in remote monitoring posts. This linear count-rate meter has a pulse amplifier and a high voltage supply for a detector. The power requirements are 115 v a-c, 0.40 amps, and 44 w. A large area α probe may be used for α particle detection. Beta particles and γ radiation are detected by a geiger tube. This instrument provides a 1-ma telemetering signal, a 10-mv strip chart recorder signal, an alarm control signal, and an audible indication of counting rate. (F.S.)

2655 A DEVICE FOR MEASURING THE CONCENTRATION OF GASEOUS-PHASE FISSION PRODUCTS. Andre Roguin (to Commissariat à l'Énergie Atomique). British Patent 970,368. Sept. 23, 1964. Priority date June 2, 1960, France.

A coolant monitoring device is described. A movable electrode on a piston collects radioactive ions and moves them close to a scintillation detector. The piston is activated by solenoid coils. (T.R.H.)

2656 MEASURING INSTRUMENT FOR IONIZATION RADIATION. Juergen Lammering. German Patent 1,174,433. July 23, 1964. Filed Feb. 21, 1962.

A circuit diagram for a battery-operated Geiger-Mueller counter is given, which operates a loudspeaker or an integrating measuring device. The first circuit consisting of the counter tube, a counter-pulse-controlled transistor, which serves for a switch, and the primary winding of a transformer is inductively coupled to a second circuit consisting of the secondary winding of the transformer, a rectifier, and the loudspeaker or the measuring device. (Gmelin Inst.)

2657 GEIGER-MUELLER COUNTER TUBE FOR MEASUREMENT OF THE DOSE AND/OR THE DOSE RATE OF X-RAYS WITH LOW-ENERGY DEPENDENCE. Karl-Heinz Weber (to VEB Vakutronik Dresden). German Patent 1,175,366. Aug. 6, 1964. Filed Oct. 10, 1961.

The wall of the Geiger-Mueller tube, which is filled with organic vapors or a mixture of argon or neon with organic or inorganic quenching agents, is made of a vacuum-tight material having an effective atomic number of less than 8 preferably of a lithium–beryllium–borate glass. The thickness of the wall is between 50 and 150 mg/cm^2. The gas pressure is chosen in such a way that the product resulting by multiplying the diameter of the tube with the density of the filling gas and the third power of the effective atomic number of the filling gas amounts to between 0.2 and 0.6 g/cm^2. (Gmelin Inst.)

2658 ARRANGEMENTS FOR DISCRIMINATING X RAYS OF DIFFERENT HARDNESS. Prabuddha Banerjee (to Siemens & Halske AG). German Patent 1,175,367. Aug. 6, 1964. Filed June 25, 1962.

The arrangement comprises an x-ray source, a semiconductor detector, and a rotatable absorber between these two elements, which interrupts the x-ray beam periodically. The thickness of the absorber is chosen in such a way that the intensity ratio of the hard radiation component penetrating the absorber to the also-penetrating soft radiation component is as high as possible. (Gmelin Inst.)

2659 IONIZATION CHAMBER. Norman Trevor Clarke (to United Kingdom Atomic Energy Authority). U. S. Patent 3,147,394. Sept. 1, 1964. Priority date Jan. 13, 1960, Great Britain.

A pressurized ionization chamber is designed which has an almost flat energy response down to low gamma ray energies. The gas fill comprises an air–argon mixture of 45 to 35 vol % air and 55 to 65 vol % argon, and the total pressure is 18 to 22 atm. (D.L.C.)

2660 METHOD OF INCREASING THE RESPONSE OF PHOTOGRAPHIC EMULSIONS TO RADIATION. Jerome Rothstein (to Edgerton, Germeshausen and Grier, Inc.). U. S. Patent 3,148,276. Sept. 8, 1964. Filed Oct. 17, 1960.

A method of increasing photosensitivity by electric fields is described. A pulsed electric field (25 to 100 μsec.) during exposure causes the electrons freed by the light to collide with the emulsion and produce other electrons. As long as the dielectric breakdown point is not exceeded, the film is rendered more sensitive by these pulses. (T.R.H.)

2661 DEVICE FOR MEASURING THE X-RAY RADIATIONS ABSORBED BY A SPECIMEN. Wijbe Johannes Oosterkamp, Klaas Reinsma, and Jan Hesselink (to North American Philips Co., Inc.). U. S. Patent 3,152,255. Oct. 6, 1964. Priority date July 24, 1959, Netherlands.

An x-ray measuring apparatus was designed to measure the energy absorbed by a specimen irradiated by a source of x rays. It consists of an ionization chamber arranged in the path of the x rays and responsive to them so that a proportional ionization current is provided. A means is coupled to the ionization chamber for integrating the ionization current over a time interval proportional to the time of exposure of the specimen to the x rays. A control means is used to provide a correction signal proportional to the quality of x radiation of the source to correct the integrating means to provide the absorbed radiation measurement. (M.C.G.)

2662 ELECTROMETER HAVING FLEXIBLE ELECTRODES AND FLEXIBLE FIBER. Francis R. Shonka (to U. S. Atomic Energy Commission). U. S. Patent 3,156,869. Nov. 10, 1964.

An improvement in the electrodes of electrometers is described, comprising replacement of the rigid deflecting electrodes with flexible deflecting electrodes having a sag equal to or greater than that of the movable fiber in the electrometer. (AEC)

2663 RADIATION DETECTION SYSTEM COMPRISING A PULSE INTEGRATOR. Harold A. Thomas (to General Dynamics Corp.). U. S. Patent 3,157,789. Nov. 17, 1964. Filed Nov. 21, 1960.

A device is described for measuring both peak intensity and total energy of a pulse of radiant energy. The voltage from an ionization chamber is stored in capacitors, and a high-impedance, relatively low-speed, inexpensive recorder sequentially records the information. (T.R.H.)

2664 A SYSTEM FOR AUTOCOLLIMATION ILLUMINATION AND PHOTOGRAPHING OF BUBBLE CHAMBERS. E. V. Kozubskii and M. Maly. Russian Patent 165,075.

A system for autocollimation illumination and photographing of bubble chambers is described. The system contains a reflecting screen mounted on the bottom of the working volume of the chamber opposite a protective glass, a light source, and camera objectives, which are situated symmetrically with respect to the light source. In order to avoid bright spots on the protective glass from the light source, the camera objectives are set at a basic distance that exceeds the width of the chamber. For illumination, an optical system is used which converts the luminous flux from the light source to an astigmatic stream, which is parallel in a section perpendicular to the length of the chamber and divergent in the mutually perpendicular section. The focal lengths of the reflecting screen in the two mutually perpendicular sections are different and have a ratio of 2:1. (OTS)

Radiation Effects

2665 (SC-R-64-1324) THE SEMICONDUCTOR DEVICE IN RADIATION DAMAGE RESEARCH. J. W. Easley (Sandia Corp., Albuquerque, N. Mex.). July 1964. Contract AT(29-1)-789. 31p. (SC-DC-1075; CONF-679-2). Dep.(mn); $2.00(cy), 1(mn) OTS.

From International Conference on the Physics of Semiconductors, Paris, July 1964.

A review is given of the methods and results of semiconductor device employment as the sample in research on the character of radiation damage in semiconductors. The presence of one or more systematically included p-n junctions distinguishes these sample structures from other sample forms. The discussion includes the utilization of devices in the determination of the recombination characteristics, displacement threshold energy, introduction-rate dependence on bombarding particle energy, band-gap energy levels, mobility, annealing and the formation-reciprocity of radiation-introduced defects. Device utilization in the study of the interaction of primary recoiling atoms with the crystal lattice is also discussed. (auth)

2666 (SC-R-64-1333) A COMPARISON OF RADIATION TOLERANCE OF FIELD EFFECT AND BIPOLAR TRANSISTORS. B. L. Gregory and F. M. Smits (Sandia Corp., Albuquerque, N. Mex.). Oct. 1964. Contract AT(29-1)-789. 10p. Dep.(mn); $1.00(cy), 1(mn) OTS.

An analytical comparison of the radiation tolerance of conventional silicon field effect transistors and of silicon bipolar transistors has been performed. The channel or base thickness has been used as the respective critical variable, since it measures the degree of difficulty of device fabrication. For field effect transistors, the pinch-off voltage has been used as a free parameter. Based on recent lifetime degradation data for bipolar transistors and on carrier removal data for material of variable resistivity, it is shown that field effect transistors are not inherently more radiation tolerant than bipolar transistors. Only field effect transistors with pinch-off voltages well in excess of 10 volts appear superior to bipolar transistors. (auth)

2667 THE SPACE PARTICULATE RADIATION ENVIRONMENT AND ITS EFFECTS ON MICROELECTRONICS. Emanuel Rind and Floyd R. Bryant (Langley Research Center, Hampton, Va.). 14p. (CONF-768-2)

From International Conference on Aerospace Electro-Technology, Phoenix, Ariz., Apr. 1964.

Space radiation environments are summarized. Proton irradiation data at 22, 40, 128, and 440 Mev for typical macroelectronic components such as low-, medium-, and high-frequency transistors as well as field-effect transistors are presented and compared with similarly irradiated discrete- and integrated-circuit types of micro-components. Damage varies inversely with energy, and integrated flux levels of approximately 10^{11} protons/cm^2 are needed before the radiation effects become noticeable. Integrated circuits appear to be slightly more resistant to radiation, but this finding may not be significant on a statistical basis. A space radiation effects laboratory is described in which protons from about 100 to 600 Mev and electrons from 500 kev to 10 Mev will be available, as well as x-rays and neutrons. (auth)

2668 A TEST TO DETERMINE THE EFFECTS OF RADIATION ON SELECTED PRESSURE TRANSDUCERS AND STRAIN GAGES. Donald R. Peters (Lockheed Aircraft Corp., Marietta, Ga.). 20p. (CONF-637-8)

From Institute of Electrical and Electronics Engineers Region 3 Annual Meeting and Technical Conference, Clearwater, Fla., May 1964.

The examination of the data developed in tests of specific pressure transducers and strain gages shows that the test specimens can survive an integrated gamma dose of 1.2×10^8 without significant changes in their operating characteristics. This test demonstrates that the problems of this radiation environment have been met in the design stage and the performance of these transducers will not be deteriorated by radiation to the levels tested. (auth)

ISOTOPE TECHNOLOGY

General

Refer also to abstracts 2884 and 3478.

2669 ISOTOPES AND RADIATION TECHNOLOGY. Volume 2, Number 1. P. S. Baker, Robert H. Lafferty, Jr., Martha Gerrard, D. A. Fuccillo, and R. E. Greene, eds. (Oak Ridge National Lab., Tenn.). Fall 1964. $0.55 (GPO) (domestic), $0.70(GPO) (foreign). (One of the Technical Progress Reviews prepared quarterly for the Division of Technical Information, USAEC). 100p. Dep.

Reviews are presented on selected developments in the fields of isotopes and radiation technology. These reviews include isotope production, tracer uses, food irradiation, radiation sources, shielding of isotopic power sources, etc. Separate abstracts were prepared for some of the reviews. (D.L.C.)

For abstracts of individual sections see: 2108, 2453, 2582, 2617, 2670, 2679, 2680, 2690, 2700, 2884, and 3478.

2670 IODINE-132. Isotopes Radiation Technol., 2: No. 1, 82-5(1964).

^{132}I is useful in medicine because of its short 2.3-hr half life, resulting in decreased radiation doses as compared to ^{131}I. The properties and production of ^{132}I are described. The separation of ^{132}Te from fission products and the milking of ^{132}I from ^{132}Te are discussed. (D.L.C.)

2671 SOME EXPERIMENTS WITH RADIONUCLIDES TO SOLVE DIFFICULTIES IN THE MECHANICS OF WATER TREATMENT PLANTS. K. Schieck (Institut für Wasserwirtschaft, Berlin). Kernenergie, 7: 667-9(Sept. 1964).

Experiments showed that difficulties in operating water treatment plants can be explained by using radionuclides. A preliminary clarification basin whose clearing capacity for river water during high pollution periods was insufficient, and an aeration tank whose biological purifying efficiency was unsatisfactory were investigated. In the two cases short circuits between inlet and outlet of the plants were found to be the cause of the difficulties. As a result of the experiments, possibilities are proposed to overcome these phenomena. (auth)

2672 BREMSSTRAHLUNG FROM STRONTIUM-90–YTTRIUM-90. Thomas S. Bustard (Martin Marietta Corp., Marietta, Ga.) and Joseph Silverman. Trans. Am. Nucl. Soc., 7: 323-4(Nov. 1964).

2673 THE EFFECT OF SPECIFIC ACTIVITY ON COBALT-60 ENCAPSULATION COST. Lawrence E. Kukacka and Bernard Manowitz (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 345(Nov. 1964). (BNL-8255)

2674 PREPARATION OF THIN FILM RADIOISOTOPE TARGETS AND SOURCES. E. H. Kobisk (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 347-8(Nov. 1964).

2675 SELECTED REFERENCES TO TRACER TECHNIQUES. R.C.C. Review 1. (Gt. Brit. Radiochemical Centre, Amersham, Bucks, England). July 1964. 12p.

A total of 165 references on the preparation of labeled compounds, applications of tracers, safety precautions, and measurement, including general, scintillation counting, gas counters and ion chambers, and photographic methods, are given to books, reports, and journals published from 1948 to 1964. (P.C.H.)

Industrial Applications

2676 (CONF-188-2) ESTUDIO DEL MOVIMIENTO DE ARENAS EN LAS CERCANIAS DEL PUERTO DE MAR DEL PLATA USANDO ARENA MARCADA CON ^{110}Ag. Informe No. 100. (Study of the Movement of Sand in the Vicinity of Puerto de Mar del Plata Using ^{110}Ag Labeled Sand. Report No. 100). Federico Lachica and Gregorio B. Baro (Argentina. Comision Nacional de Energia Atomica, Buenos Aires). 1963. 13p. Dep.(mn).

From Proceedings of the 1st Inter-American Conference on Radiochemistry, Montevideo, July 1963.

The feasibility of studying the movement of sand in the vicinity of the sea gate of the Plata River using sand labeled with ^{110}Ag was investigated. The methods used for the labeling, the deposition of the labeled sand on the sea bottom, and the sampling and measurement of samples were reported. The results showed that the labeling technique is a relatively sensitive and easy method that can be used near the sites where the tracer is to be deposited. 200 to 500 mc could be detected in an area between 80 and 100 hectares. (J.S.R.)

2677 (NYO-2906-1) RESEARCH ON APPLICATIONS OF KRYPTON-85 AND OTHER RADIOACTIVE ISOTOPES. Final Report. Arthur M. Feibush (Air Reduction Co., Inc. Central Research Labs., Murray Hill, N. J.). [nd]. Contract AT(30-1)-2906. 76p. Dep.; $3.00(cy), 2(mn) OTS.

Methods for utilizing ^{85}Kr as a radiation source were applied to a number of polymerization and graft copolymerization reactions. A unique gas phase synthesis reaction in which ^{85}Kr has a special advantage over other radiation sources was not found. However, the irradiation of thin layers at solid surfaces does represent a unique application of ^{85}Kr in which useful changes are produced in the surface without affecting the substrate. It was shown that alpha and beta emitters in concentrations up to 42 $\mu C/ft^2$ of heat transfer surface did not enhance nucleation in nucleate boiling regimes in a boiling liquid system. A useful method was developed for direct comparison of efficiency of two heat transfer surfaces in a boiling liquid. Trans-polyacetylene was produced by the irradiation of gaseous acetylene. O_2 must be rigorously excluded in order to obtain the homopolymer. Unsaturated hydrocarbon gases irradiated in the presence of O_2 formed a highly oxygenated polymer. No homopolymer was formed. This novel oxidation-polymerization reaction was studied with five hydrocarbons. The properties of the polymers were independent of the reaction conditions and the starting hydrocarbon. The O_2 was incorporated in the polymer structure in the form of carboxylic acid groups and carbonyl groups, most of which were in the enol form. The generality of this reaction suggests the possibility of similar reactions with other electrophilic reagents. Polymerization of carbonyl compounds at low temperatures was initiated by radiation. The homopolymers formed are thermally unstable and reverted to monomers or dimers. Irradiation of liquid O_2 at liquid N_2 temperatures did not result in formation of significant quantities of ozone. (auth)

2678 (ORNL-P-657) THE RADIOISOTOPES SOURCE SAFETY TESTING PROGRAM OF THE UNITED STATES ATOMIC ENERGY COMMISSION. Eugene Lamb and R. A. Robinson (Oak Ridge National Lab., Tenn.). [1963]. Contract W-7405-eng-26. 21p. (CONF-800-2). Dep.(mn); $2.00(cy), 1(mn) OTS.

From 6th Japan Conference on Radioisotopes, Tokyo, Nov. 1964.

The problem of sealed radioisotope source rating and testing in the licensing and regulation of the use of such sources is discussed. A description is given of AEC's Source Safety Testing Program, and the results of on-site surveys of industrial application environments are summarized. The Source Capsule Classification System, a means for classifying source designs, is also described; some classification tests are outlined. The examination of leaking sources after use is considered. The Source and

Application Rating System is also under development. (D.L.C.)

2679 RADIOACTIVE TRACER USES IN THE MINING INDUSTRY. Isotopes Radiation Technol., 2: No. 1, 18-34 (1964).

A discussion is presented of specific studies on radiotracers in the mining industry. These studies include studies of the effects of particle size and density on separation of coal fractions in water-fluidized beds, and studies of sorting of Cu-bearing ores from barren material. Coal that had been irradiated in a reactor, and Cu ores that had been activated either by irradiation or by adsorption of ^{64}Cu were used in these studies. (D.L.C.)

2680 SOURCE DEVELOPMENT. Isotopes Radiation Technol., 2: No. 1, 55-7(1964).

A review is presented of the use of radioisotopes as radiation sources in industrial and medical radiography. (D.L.C.)

2681 SUITABILITY OF POTATO PRODUCTS MADE FROM IRRADIATED POTATOES. George A. Freund (Western Nuclear Corp., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 7: 315(Nov. 1964).

2682 PRECISION TRACKING TECHNIQUE UTILIZING GAMMA RAYS. A. J. Campanella (Industrial Nucleonics Corp., Columbus, Ohio). Trans. Am. Nucl. Soc., 7: 343 (Nov. 1964).

2683 TECHNISCHE TOEPASSINGEN VAN RADIOISOTOPEN. Teksten van Voordrachten van een Symposium met Bovengenoemd Onderwerp, Gehouden te Delft op 17, 18 en 19 April 1963. (Technical Applications of Radioisotopes. Texts of Papers of a Symposium in Delft, April 17-19, 1963). The Hague, Nederlands Atoomforum, [1964]. 158p.

Sixteen papers presented at a Symposium on the Technical Applications of Radioisotopes in Delft, April 17 to 19, 1963, are presented. (M.C.G.)

2684 PROCEEDINGS [OF THE] NUCLEAR APPLICATIONS TO THE WOOD, PAPER, AND PULP INDUSTRIES CONFERENCE, APRIL 23-24, 1964, WASHINGTON STATE UNIVERSITY, PULLMAN, WASHINGTON. (Washington State Univ., Pullman). 156p. (CONF-624). $3.00; Washington State Univ., Pullman, Wash.

From Symposium on Nuclear Applications to the Wood, Paper and Pulp Industries, Pullman, Wash., Apr. 1964.

Twelve scientific papers, one abstract, and one popular-type article are presented which discusses the principles of nuclear energy and activation analysis and their practical applications in industry, particularly the wood, paper, and pulp industry. The modification of wood using plastics and radiation, process control, tracer methods, air pollution, and radioisotope applications are among the topics treated. Separate abstracts were prepared for eleven of the papers; for the other paper, see NSA 18: 35914. (D.L.C.)

For abstracts of individual papers see: 2263, 2264, 2265, 2416, 2584, 2685, 2686, 2687, 2688, 2689, and 2885.

2685 OPPORTUNITIES FOR TECHNOLOGY TO ADVANCE THE PROGRESS OF THE WOOD PRODUCTS INDUSTRY. A. S. Gregory (Weyerhaeuser Timber Co., Tacoma). p.1-6 of "Nuclear Applications to the Wood, Paper, and Pulp Industries Conference." Pullman, Wash., Washington State Univ., 1964.

An outline is presented of the technological areas important in the forest products industry: fundamental knowledge of raw materials and products, forestry, chemical products, fabrication, adhesives, wastes, etc. Possible applications of nuclear technology in these areas are pointed out. (D.L.C.)

2686 WORLDWIDE STATUS OF NUCLEAR APPLICATIONS TO THE WOOD, PAPER AND PULP INDUSTRIES. P. C. Aebersold (U. S. Atomic Energy Commission, Washington, D. C.). G. J. Rotariu, and F. J. Weiss. p.27-47 of "Nuclear Applications to the Wood, Paper, and Pulp Industries Conference." Pullman, Wash., Washington State Univ., 1964.

A review is presented of the applications and uses of radiation and radioisotopes in the major foreign countries of the world in their wood, paper, and pulp industries. The following subject areas are covered: silviculture and lumbering, gamma-irradiation of wood, radiological examination of wood products, and the pulp and paper industry. An extensive bibliography is included. (D.L.C.)

2687 THE APPLICATION OF INTRINSIC RADIOTRACERS TO PROCESS CONTROL. P. Gluck, C. W. Townley, and D. N. Sunderman (Battelle Memorial Inst., Columbus, Ohio). p.73-104 of "Nuclear Applications to the Wood, Paper, and Pulp Industries Conference." Pullman, Wash., Washington State Univ., 1964.

A review is presented of the use of radiotracers in production measurement and control. The on-site, in-stream production of short-lived radioisotopes by neutron sources is discussed in some detail, as it eliminates the problem of product contamination. Instrumentation for measuring stream radioactivity is also considered. The applicability of radiotracers to process control in separations, dispersions, and flow measurements is discussed for both long- and short-lived radiotracers. Tables are included giving the commercially available long-lived radiotracers and the base sensitivities of elements for in-process activation. An example of radiotracer application is given in which the iron-removal step in a nickel-refining process was studied. (D.L.C.)

2688 APPLICATION OF RADIOISOTOPES IN PAPER MILLS. Alvin Moore (International Paper Co., Bastrop, La.). p.125-9 of "Nuclear Applications to the Wood, Paper, and Pulp Industries Conference." Pullman, Wash., Washington State Univ., 1964.

A discussion is given of the use of radioisotopes in measuring the level, density or specific gravity, and basis weight in paper mills. The beta gage which is used to measure the basis weight of the sheet is discussed in some detail, and experiences in its use are described. (D.L.C.)

2689 RADIOMETRIC DETERMINATION OF ABRASIVENESS OF MATERIALS FOR USE IN PAPER. W. J. Hampton, A. W. Naumann, and Werner H. Wahl (Union Carbide Corp., Tuxedo, N. Y.). p.131-9 of "Nuclear Applications to the Wood, Paper, and Pulp Industries Conference." Pullman, Wash., Washington State Univ., 1964.

A radiometric method for determining the relative abrasiveness of slurries was developed which is based on the measurement of radioactivity transferred to the slurry from the irradiated impeller of a blender during a prescribed blending period. Tests with asbestos and other materials were carried out. Good correlations were obtained between the radioactivity data and the known Valley Abrasion Values. (D.L.C.)

Power Application

2690 SHIELDING REQUIREMENTS FOR ISOTOPIC POWER SOURCES. E. D. Arnold (Oak Ridge National Lab., Tenn.). Isotopes Radiation Technol., 2: No. 1, 72-81(1964).

A handbook (ORNL-3576) which gives shielding requirements for isotopic power sources is described. The references which were used in the preparation of the handbook are reviewed. Data reliability, radiation hazards and level calculations, radiation production in decay processes, etc., are discussed. Nuclear data for some isotopes are tabulated, and gamma dose rates from shielded ^{60}Co sources are plotted versus shield thickness. (D.L.C.)

2691 A NON-LINEAR ANALYSIS OF THE TRANSIENT BEHAVIOR OF THERMOELECTRIC GENERATORS WITH TEMPERATURE-DEPENDENT PHYSICAL PARAMETERS. David Tai-ko Shaw (Purdue Univ., Lafayette, Ind.). Trans. Am. Nucl. Soc., 7: 376-7(Nov. 1964).

2692 RADIOISOTOPIC POWER GENERATION. William R. Corliss and Douglas G. Harvey. Prentice-Hall International Series in Space Technology. Englewood Cliffs, N. J., Prentice-Hall, Inc., 1964. 312p.

A survey is presented of general design considerations (radioisotope fuels, safety, energy conversion characteristics, and generator design principles) and specific radioisotope generators (undersea and space units, nuclear batteries, and advanced concepts). (T.F.H.)

Separation and Production

2693 (BNL-3138) PRODUCTION AND AVAILABILITY OF MAGNESIUM-28. L. G. Stang, Jr., W. D. Tucker, A. J. Weiss, and H. O. Banks, Jr. (Brookhaven National Lab., Upton, N. Y.). [195?]. Contract AT-30-2-GEN-16. 16p. (CONF-809-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Nuclear Society Winter Meeting, Washington, D. C., Dec. 1956.

^{28}Mg, with its long life, would be a valuable tracer in biological studies. An attempt was made to develop a reliable process for producing ^{28}Mg in sizable quantities. The ^{26}Mg(t,p) reaction was selected, using tritons produced by the (n,α) reaction on Li in the reactor. The theory of the reaction is discussed. Initial studies were made using Li–Mg compound mixtures and alloys, and it was found possible to produce routinely specific activities of >1000 μC/g by using Mg–75 wt % ^{6}Li foils. The chemical processing of the irradiated foils and the contaminants found are discussed. The decay curve gives a half life of 21.3 hr. (D.L.C.)

2694 (K-OA-899) COMPARISON OF METHANE, CARBON MONOXIDE, AND CARBON DIOXIDE AS THERMAL DIFFUSION MEDIA FOR THE SEPARATION OF THE CARBON ISOTOPES. S. Blumkin and E. Von Halle (Oak Ridge Gaseous Diffusion Plant, Tenn.). Aug. 7, 1961. Contract W-7405-eng-26. 6p. Dep.(mn); $1.00(cy), 1(mn) OTS.

CH_4 has the advantage of low molecular weight but the disadvantage of decomposition at temperatures >450°C (calrod heaters normally operate at 550°C). A comparison was made of the effectiveness of CH_4, CO, and CO_2 as the process gas for production of 90% ^{13}C in concentric-tube columns. The results show that CH_4, even at the lower operating temperature, is superior to either CO or CO_2. (D.L.C.)

2695 (K-OA-1150) A THERMAL DIFFUSION PLANT DESIGN FOR THE ENRICHMENT OF ARGON-38 TO A CONCENTRATION OF FIFTY PERCENT. S. Blumkin and E. Von Halle (Oak Ridge Gaseous Diffusion Plant, Tenn.). Apr. 22, 1963. Contract W-7405-eng-26. 6p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A plant design is given for producing ~10 mg/day of argon containing 50% ^{38}Ar. The plant includes a primary cascade of 7 columns and a secondary cascade of 21 columns. The reject streams from the primary and secondary cascades are highly enriched ^{36}Ar and ^{40}Ar, respectively. (D.L.C.)

2696 (K-OA-1173) PERFORMANCE TESTS OF THERMAL DIFFUSION COLUMNS OPERATING WITH METHANE: I. TOTAL REFLUX OPERATION. S. Blumkin (Oak Ridge Gaseous Diffusion Plant, Tenn.). July 5, 1963. Contract W-7405-eng-26. 11p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Two experiments are to be conducted to study the behavior of a single column and of three columns connected in series, operating at total reflux. Calculations are given for the theoretical transient behavior of the columns for these two tests. (D.L.C.)

2697 (K-OA-1195) PERFORMANCE TEST OF THERMAL DIFFUSION COLUMNS OPERATING WITH METHANE: II. OPERATION WITH CONTINUOUS PRODUCT WITHDRAWAL. S. Blumkin (Oak Ridge Gaseous Diffusion Plant, Tenn.). Sept. 19, 1963. Contract W-7405-eng-26. 5p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The test was conducted using three standard ORNL nominal $\frac{3}{4}$-in. by 7$\frac{1}{2}$-in. columns operating at a calrod surface temperature of 400°C and a pressure of 4 atm. The feed was sufficient to approximate operation over an infinite reservoir. Continuous withdrawal of product is assumed. Experimental data are included. (J.R.D.)

2698 (NP-14370) FUENTE DE IONES PARA UN SEPARADOR DE ISÓTOPOS. Informe No. 114. (Ion Source for an Isotope Separator. Report No. 114). Moisés J. Sametband (Argentina. Comisión Nacional de Energía Atômica, Buenos Aires). 1964. 37p. Dep.(mn).

The ion source now in use at the Buenos Aires Isotope separator is described. It has a heated cathode with a collimated arc for the magnetic field of the separator and with an oven capable of evaporating materials up to 700°C. Measurements were made with Ar, N, and Zn to determine coefficients of diffusion for the discharge. Problems connected with obtaining the most suitable pressure for the discharge chamber are discussed. The effects of the acceleration system on the ion beam at various ma currents are described. The space charge tends to decrease the separating power of the machine; it is thought that this effect could be reduced if the beam is made to converge near the output slit of the ion source. A method to make possible the use of accelerator systems for ions with space charge and predetermined form is described. (tr-auth)

2699 STABLE ISOTOPE SEPARATION. II. PRODUCTION PROCESSES. C. U. Linderstroem-Lang (Atomenergikommissionens Forsogsanlaeg, Riso, Denmark). Dansk. Kemi., 43: 165-71(1962). (In Danish)

The principles of the methods used in heavy water production are summarized, and then individual methods are described in some detail. The production of tritium, lithium isotopes, ^{10}B, other light isotopes, and ^{235}U is discussed. The countercurrent gas ultracentrifuge method is also considered. (J.S.R.)

2700 PRODUCTION OF ^{28}Mg: STATE OF THE ART. Allen J. Weiss and Manny Hillman (Brookhaven National Lab., Upton, N. Y.). Isotopes Radiation Technol., 2: No. 1, 8-10(1964).

A literature review is presented of research on methods of production of ^{28}Mg. Methods used at Brookhaven and Harwell are described in some detail. The preparation of carrier-free ^{28}Mg is considered. (D.L.C.)

2701 RESEARCH OF RADIOISOTOPE PRODUCTION WITH FAST NEUTRONS. VII. PRODUCTION OF SEVERAL RADIOISOTOPES OF HIGH SPECIFIC ACTIVITY IN JRR-1 REACTOR. Eiji Shikata (Japan Atomic Energy Research Inst., Tokyo). J. Nucl. Sci. Technol. (Tokyo), 1: 228-35(Oct. 1964).

The production of radioisotopes of high specific activity was studied in the JRR-1 reactor using several (n,p) and (n,α) reactions, such as ^{24}Mg(n,p)^{24}Na, ^{27}Al(n,α)^{24}Na, ^{35}Cl(n,p)^{35}S, ^{35}Cl(n,α)^{32}P, ^{58}Ni(n,p)^{58}Co, ^{64}Zn(n,p)^{64}Cu, and ^{67}Zn(n,p)^{67}Cu. The target materials for these reactions were irradiated in several experimental holes of JRR-1 and the radioisotopes formed in the target materials were separated. The amount of the radioisotopes produced and the specific activity were determined, and the possibility of producing high specific activity radioisotopes by these reactions was investigated. The specific activity of the radioisotopes produced by the (n,p) and (n,α) reactions was more than several hundreds times higher than when produced by the corresponding (n,γ) reactions. Although the yield of the radioisotopes by the former two reactions was fairly small, practical production of high specific activity radioisotopes by this method was thought to be possible, at least for elements of lower atomic number. For each experimental hole, the thermal and the fast neutron fluxes were determined respectively by the reactions ^{197}Au(n,γ)^{198}Au and ^{58}Ni(n,p)^{58}Co. In order to apply these

(n,p) and (n,α) reactions effectively to radioisotope production, such basic informations as the dependence of the reactions on neutron energy and the effect of irradiation position on the reaction yield were studied on the basis of the neutron flux distribution, and the cross section of the reactions for fast neutrons in JRR-1 was estimated. (auth)

2702 CONSTRUCTION OF NICKEL FILTER AND TITANIUM CONTAINER FOR DEUTERIUM AND TRITIUM. Czeslaw Bobrowski, Edward Chrusciel, and Kazimierz Ostrowski. Przeglad Elektron., 5: 406-11(Aug. 1964). (In Polish)

2703 RAPID SEPARATION OF HYDROGEN ISOTOPES BY GAS SOLID CHROMATOGRAPHY. Preston L. Gant (Continental Oil Co., Ponca City, Okla.). Trans. Am. Nucl. Soc., 7: 335-6(Nov. 1964).

2704 PROBLEMS IN THE PRODUCTION OF HIGH-SPECIFIC-ACTIVITY RADIOISOTOPES BY SZILARD-CHALMERS REACTIONS IN CRYSTALLINE SOLIDS. G. E. Boyd (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 346-7(Nov. 1964).

2705 THERMAL DIFFUSION IN T_2-H_2, $DT-H_2$, AND T_2-D_2. W. Reichenbacher and A. Klemm (Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch., 19a: 1051-7 (Sept. 1964). (In German)

With a previously used Clusius-Nickels separation tube the thermal diffusion factor α of T_2-H_2, $DT-H_2$ and T_2-D_2 was determined to be 0.210 ± 3.5%, 0.186 ± 3.5%, and 0.074 ± 6%, respectively. The temperatures on the cold and hot walls amounted to 20 and 130°C. The tritium-containing gas was always present in traces. The given α values were related to the value 0.149 for D_2-H_2. By means of a compensating calculation, from the eight now-known α values for hydrogen mixtures, the coefficients occurring in the relations $\alpha_{12} = 0.429\ \Delta m/m - 0.112\ (\Delta m_1^2/m_1^2 - \Delta m_2^2/m_2^2)$ or $\alpha_{12} = 0.225\ \Delta m/m + 0.203\ \Delta\theta/\theta$ were determined, where m and Δm are the sum and difference of the molecular masses, $m_{1,2}$ and $\Delta m_{1,2}$ the sums and differences in molecules 1 or 2, and θ and $\Delta\theta$ the sum and difference of the molecular moment of inertia. Both relations reproduce the eight α values equally well. (tr-auth)

2706 YTTRIUM-90 GENERATOR. R. F. Doering and Walter D. Tucker (to U. S. Atomic Energy Commission). U. S. Patent 3,156,532. Nov. 10, 1964.

A multizoned ^{90}Y generator for milking ^{90}Y from ^{90}Sr is described, having provision for adequate shielding and retraction of the delivery tube to limit radiation hazards. (AEC)

MATHEMATICS AND COMPUTERS

2707 (BNL-8432) COMPUTER ANALYSIS OF GAMMA-RAY SPECTRAL DATA OBTAINED BY WHOLE-BODY COUNTING. S. H. Cohn and E. A. Gusmano (Brookhaven National Lab., Upton, N. Y.). [1964]. Contract AT-30-2-GEN-16. 19p. (CONF-754-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From International Business Machines Medical Symposium, Poughkeepsie and Upton, N. Y., Oct. 1964.

The technique of gamma-ray measurement by pulse-height analysis provides the most rapid and accurate determination of internally-deposited radionuclide abundances in man. Scintillation spectrometer pulse-height distribution data were analyzed to quantify the levels of ^{137}Cs, ^{65}Zn, ^{40}K and other radionuclides in several hundred subjects. In a large-scale study of this kind, it was found desirable to employ automatic data-handling techniques, including computer analysis of the spectral data. The whole-body counter data of the subjects were compared with those obtained from a phantom (REMAB) containing standardized solutions of a number of monoenergetic gamma emitters. A number of Fortran II programs for the IBM-7094 were used for the reduction of the pulse-height distribution data. The programs first perform a non-linear least-squares fit of a Gaussian function to the data points in the spectrum photopeaks. The associated Compton distribution required in the stripping program is then computed by interpolation from an experimentally derived matrix of seven monoenergetic gamma rays. Commencing with the highest energy, each designated photopeak and its associated Compton is subtracted off until the complex spectrum is analyzed. Other programs take the initial spectral data from the analyzer in the form of punched paper tape and convert it to magnetic tape for use in the above stripping programs. This technique desribed appears capable of providing rapid and accurate quantitative interpretation of pulse-height distribution data, applicable to the determination of body burdens of various radionuclides. It was shown that the method is less subjective than the usual graphic method for interpreting spectral data. The accuracy attainable and limitations of this computer analysis are discussed along with the results of specific population surveys for estimating body burdens. (auth)

2708 (LADC-6133) EXISTENCE THEOREMS FOR QUASI-LINEAR ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS IN n VARIABLES. Zane Clinton Motteler (Los Alamos Scientific Lab., N. Mex.). Jan. 1964. Contract W-7405-eng-36. 44p. Dep.(mn); $2.00(cy), 1(mn) OTS.

Thesis submitted to Stanford Univ., Calif.

The existence of solutions for two types of boundary-value problems in the theory of quasi-linear second-order elliptic partial differential equations is proved. Diverse hypotheses are used for inhomogeneous equations with zero boundary values and homogeneous equations with non-zero continuous boundary values in Euclidean n-space. (R.E.U.)

2709 (NIRL/R/72) THE DIALECT OF FORTRAN ACCEPTED BY THE ORION FORTRAN COMPILER. R. Taylor (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Chilton, Berks, England). July 1964. 19p. Dep.(mn); $0.70(BIS); 3s.6d.(HMSO).

Deviations from the IBM Fortran II dialect used in the Orion Fortran Monitor System are described. (R.E.U.)

2710 (ORNL-3688) SOME ALGORITHMS FOR THE CALCULATION OF THE CHARACTERISTIC ROOTS AND VECTORS OF A NORMALIZABLE MATRIX (thesis). D. H. Clanton (Oak Ridge National Lab., Tenn.). Oct. 1964. Contract W-7405-eng-26. 55p. Dep.; $3.00(cy), 1(mn) OTS.

Submitted to Auburn Univ.

The thesis presents, for a normalizable matrix A of order n, different algorithms for the development of a sequence of normalized vectors $q^{(l)}$, (l = 0, 1, 2, ...), such that the centers of their associated Weinstein disks are the Rayleigh quotients, $q^{(l)H}A\,q^{(l)}$. If the radii of the Weinstein disks approach zero as a limit, then the Rayleigh quotients associated with the sequence of vectors converge to a characteristic root of A. A new vector $q^{(l+1)}$ is chosen from a subspace spanned by a set of mutually orthogonal vectors that contains the old vector $q^{(l)}$. The radius of the Weinstein disk associated with this vector $q^{(l+1)}$ will not be larger than the radius of the one associated with $q^{(l)}$ and will, in general, be smaller. The condition that the radii of the Weinstein disks converge to zero is presented. Algorithms are discussed for the subspace of dimension two. It is shown that the simplest algorithm from the standpoint of operational count does not always yield vectors whose associated Rayleigh quotients converge to a characteristic root of A. The algorithm for a normal matrix always yields vectors whose associated Rayleigh quotients converge to a characteristic root of A with one exception. If a Weinstein disk has two or more characteristic roots on its boundary, then the algorithm will not yield a new vector. Any algorithm, however, that belongs to the class of algorithms presented will also have the same exception. In the case of a hermitian matrix, a method is presented that will take care of the exception. (auth)

2711 (SC-R-64-1355) THE DESIGN AND ANALYSIS OF ELECTRONIC CIRCUITS BY DIGITAL COMPUTERS. J. L. Wirth (Sandia Corp., Albuquerque, N. Mex.). Oct. 1964. Contract AT(29-1)-789. 23p. (SC-DC-64-1573; CONF-776-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From National Electronics Conference, Chicago, Oct. 1964.

The role of the digital computer in the design and analysis of electronic circuits is discussed with special attention given to the problems created by steady-state and transient nuclear environments. Examples are presented which illustrate the usage, capability, and limitations of several existing analysis programs. The current direction of research and programming efforts in the area of automatic circuit analysis programs is also considered. (auth)

2712 ON MINIMIZING THE STATISTICAL ERROR IN MEASURING AND CALCULATING NORMALIZED NUCLEAR COUNTING RATES. K. Winkler (Institut für Physikalische Chemie, Berlin). Kernenergie, 7: 611-14(Aug. 1964). (In German)

The statistical error Δf of the function $f(J) = J_\infty - J(\Theta)/J_\infty - J_0$ (J_∞ = standard counting rate, $J(\Theta)$ = counting rate variable in time Θ, J_0 = background counting rate) may be minimized for a certain total measuring period $T_{1,2} = (Kt_\infty, t) + l_{t_0}$ (t_1 = measuring periods of the counting rates: K, l = const). Optimal conditions of measurement are given for the total pulse interval $J_0 \leq J \leq J_\infty$ and partial pulse intervals $J_0 < J_1 \leq J \leq J_2 \leq J_\infty$. (auth)

2713 THE PRINCIPLES AND APPLICATIONS OF VARIATIONAL METHODS. Martin Becker. Cambridge, Massachusetts, Massachusetts Institute of Technology, 1964. 130p. $5.00.

Fundamental variational calculus techniques are described. As an example, these are applied to the calculation of fuel depletion in nuclear reactors. (T.F.H.)

METALS, CERAMICS, AND OTHER MATERIALS

General

Refer also to abstracts 2907 and 3689.

2714 (AD-606050) MECHANICAL PROPERTIES OF METALS AND THEIR CAVITATION DAMAGE RESISTANCE. Technical Report 233-5. A. Thiruvengadam and Sophia Waring (Hydronautics, Inc., Laurel, Md.). June 1964. Contract Nonr 3755(00) (FBM). 39p. $2.00 (OTS).

Detailed investigations with a magnetostriction apparatus were carried out to determine the cavitation damage resistance of eleven metals in distilled water at 80°F. The cavitation damage resistance is defined as the reciprocal of the rate of volume loss for a given metal. Among the mechanical properties investigated (ultimate tensile strength, yield strength, ultimate elongation, Brinell hardness, modulus of elasticity, and strain-energy), the most significant property which characterizes the energy absorbing capacity of the metals, under the repeated, indenting loads due to the energy of cavitation bubble collapse in the steady state zone, was found to be the fracture strain energy of the metals. The strain energy is defined as the area of the stress-strain diagram up to fracture. The correlation between the strain energy and the reciprocal of the rate of volume loss leads directly to the estimation of the intensity of cavitation damage; this intensity varies as the square of the displacement amplitude of the specimen. All these conclusions are limited to the steady state zone of damage. (auth)

2715 (AERE-R-4700) THE EMISSION OF XENON-133 FROM URANIUM CARBONITRIDES. P. Biddle (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Sept. 1964. 11p. Dep.; $0.30(BIS), 1s. 9d. (HMSO).

The emission of ^{133}Xe from a range of uranium carbonitride powders after short irradiations has been studied by the post-irradiation heating technique. The work shows that the release from carbonitrides is comparable to that from uranium monocarbide. (auth)

2716 (BMI-1681(Del.)) PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JULY, 1964. Russell W. Dayton and Ronald F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Aug. 1, 1964. Contract W-7405-eng-92. 45p. Dep.; $2.00(cy), 1(mn) OTS.

Progress is reported on development of reactor materials and components, reactor fuel development, radioisotope and radiation applications, development of coated-particle fuel materials, corrosion studies of fluoride-volatility process, gas-cooled reactor development, and development of radioisotopic power sources. (J.R.D.)

2717 (BMI-X-10100) DEVELOPMENT OF URANIUM MONONITRIDE. Quarterly Progress Report for July–September 1964. Donald L. Keller (Battelle Memorial Inst., Columbus, Ohio). Oct. 1, 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract W-7405-eng-92. 12p. (EURAEC-1232). Dep.(mn); $1.00(cy), 1(mn) OTS.

Activities in a program to evaluate UN fabrication methods are reported. Investigations of UN properties and irradiation behavior are also reported. Progress is reported on melting and casting of UN, postirradiation examination of UN samples, and compatibility studies. (J.R.D.)

2718 (CEA-TP-1593) CHOIX ET MISE EN OEUVRE D'UN ACIER AUSTENITIQUE POUR LA CONSTRUCTION DE LA CUVE DU REACTEUR A NEUTRONS RAPIDES RAPSODIE. (The Use of Austenitic Steel as Construction Material for the Pressure Vessel of the Fast Reactor ("Rapsodie"). A. Guegnaud and C. Roques (Société Anonyme des Forges et Ateliers du Creusot, Le Creusot, France). 1964. 29p. (EUR-1642.f; CONF-777-1). Dep. (mn).

From Symposium on Materials for Cooling Reactors with Sodium, New York, Nov. 1963.

The concept of the RAPSODIE reactor vessel is such that an 18/8 austenitic steel has been selected in order to obtain satisfactory resistance to corrosion and creep at 540°C. In particular, the steel used had to contain an element which would improve its creep behavior. However, special studies had to be carried out on the development of such a steel, on account of the difficulties which welded pipes of 18/8 niobium-steel cause turbine designers, both in fabrication and in operation. The studies concerned the following points: (1) Determination of the composition of the steel: the creep tests on 18/8 steels containing molybdenum or niobium additions showed the former to be superior. In particular, they were found to be completely impervious to notch impact in the base metal zone affected by the welding heat. (2) Determination of the optimum structure of the weld-deposited metal: cracking and embrittlement tests showed that it was essential to obtain a delta ferrite content of between 3 and 6%. These results have been borne out by experience, since no fabrication incidents occurred during the welding and heat-treatment of the vessel of the Rapsodie mock-up, which is made of 17 Cr/13Ni/2Mo steel and welded with electrodes having a controlled ferrite content. (auth)

2719 (DMIC-Memo-176) PREPARATION AND PROPERTIES OF FIBER-REINFORCED STRUCTURAL MATERIALS. D. E. Price and H. J. Wagner (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Aug. 22, 1963. Contract AF33(616)-7747. 24p. (AD-422242). $0.75(OTS).

Metallic fibers in the form of whiskers, chopped fine wire, or wool have been incorporated into metallic matrices by two principal methods: classical powder-metallurgical methods, and infiltration of the fibers with molten matrix metal. Ceramic fibers, notably $\alpha-Al_2O_3$, have been used as whiskers or wool for reinforcing metallic matrices, the methods of preparation of the composite being the same as with metallic fibers. When metallic fibers are used to reinforce ceramics, the ceramic is either slip cast into the fiber mat and dried, or a mixture of the fiber and ceramic is hot pressed. Plastics and elastomers are combined with fibers by several methods, for example, dipping a sintered skeleton of the fibers into liquid Teflon. Several programs have resulted in combinations which show that reinforcement of metals by either metallic or $\alpha-Al_2O_3$ fibers is possible. Both the room-temperature and elevated-temperature tensile properties of the composite seem to increase linearly with the volume fraction of the fiber phase. Reinforcement of ceramic materials by metallic fibers seems to have been less successful. However, some degree of improvement of thermal-shock resistance has been noted, a fact explained by considering that the metallic fibers prevent the propagation of cracks. The stress-strain behavior of fiber-reinforced metals varies with the amount and type of fiber. It has been observed that the work hardening rate in the early stages of plastic deformation of reinforced silver composites is strongly dependent on the fiber type. The initial yield point, on the other hand, seems much less dependent on the nature of the fiber. Certainly, there are important problems in processing still to be solved. Fiber-to-matrix bonding and the degree of strengthening achieved in any system depend on fiber type, fiber properties, orientation, type of composite, temperatures and pressures used in making the composite, mechanical work, and many other variables. Nevertheless, a sufficient number of successful combinations have

been achieved to indicate that there are potentialities for developing useful fiber-reinforced structural materials. (auth)

2720 (HW-80178) ANNEALING EFFECTS ON HYDROGEN EMBRITTLEMENT IN INNER SUPPORTS. D. P. O'Keefe (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 29, 1963. Contract AT(45-1)-1350. 6p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Mechanical test and metallographic data indicate that alpha phase annealing of the Zircaloy-2 inner supports will largely eliminate the tendency for embrittlement during autoclaving. An annealing temperature between 650 and 700°C definitely alters the texture of the strip and the grain growth is not excessive. The preliminary data of this test indicate that a temperature greater than 650°C is necessary to assure the proper heat treat response from all lots. (auth)

2721 (JAERI-4030) BEHAVIORS OF Kr AND Xe IN URANIUM METAL. RELEASE OF Kr AND Xe FROM METALLIC URANIUM. Ryukichi Nagasaki and Satoru Kawasaki (Japan Atomic Energy Research Inst., Tokyo). June 1964. 32p. (In Japanese). Dep.(mn).

Many studies have been reported on diffusion coefficients of Kr and Xe in irradiated uranium, but the coefficient values reported have not agreed well. In the present study, these diffusion coefficients are considered, using the results of experiments obtained and the diffusion equations, and the factors influencing the coefficients are studied. When the sample was heated under inert gas atmosphere, the apparent diffusion coefficient increased. For highly irradiated samples, the diffusion coefficient was smaller. When the sample was heated in an inert gas atmosphere, the release of gases was suddenly increased at the transformation point, and the gas release by thermal cycle was also increased. It is very probable that the gas bubbles migrate as a result of the surface diffusion of the matrix atoms. The diffusion coefficients obtained by the glow-discharge method for Ar, Kr, Xe in Ag, and the behavior of the Kr and Xe released out of the molten uranium metal are given. (auth)

2722 (ML-TDR-64-55) DEVELOPMENT OF A CEMENTATION COATING PROCESS FOR HIGH-TEMPERATURE PROTECTION OF MOLYBDENUM. P. J. Chao, B. S. Payne, Jr., and D. K. Priest (Pfaudler Co., Rochester, N. Y.). Mar. 1964. Contract AF33(616)-7192. 101p. (AD-436003). $2.50(OTS).

A pack cementation coating process was successfully developed to protect molybdenum alloy entry vehicle components against oxidation at temperatures near 3000°F. Designated PFR-6, the 2 to 3 mil diffusion coating is a silicide prepared from a siliconizing pack containing small amounts of niobium powder. It was evaluated statistically in an Analysis of Variance study to demonstrate an average lifetime of 1.36 hr in an oxyacetylene torch at a temperature exceeding 3000°F. The 95% confidence limit is 0.81 to 1.91 hr at the same temperature. Three major process concepts were studied: single-cycle codeposition, multicycle codeposition, and multicycle alternate layer coatings. Using these processes, 41 types of coatings were made and screened initially, from which 5 were selected for further evaluation. An intensive study of processing and testing variables employing a formal statistical approach resulted in the choice of the single-cycle PFR-6 coating for process optimization. Pack composition, process time, and process temperature were optimized. Recommendations are made for scale-up development of the coating process. (auth)

2723 (NAA-SR-Memo-10191) EVALUATION OF GRID METHOD FOR METALLOGRAPH DETERMINATION OF WEIGHT PERCENT CARBON IN HYPOSTOICHIOMETRIC URANIUM. E. E. Ritchie and J. L. Tibbetts (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). June 18, 1964. Contract AT-11-1-GEN-8. 12p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A compilation is presented of data obtained from three statistical test methods for determining the amount of excess alpha uranium present in hypostoichiometric uranium carbide. The three test methods were: (1) Superimposing a grid on several areas of a photomicrograph and counting the number of grid intercepts falling on alpha uranium. The percent of intercepts on alpha uranium is converted to weight percent carbon. (2) Comparison of metallographically prepared microstructures to photomicrographs of standards with known carbon contents. (3) Chemical carbon analysis of the material. The following conclusions were obtained from this evaluation: (1) Precision of both the grid intercept and the metallographic comparison methods increase with increasing carbon content. (2) Precision also increases with an increasing number of samples. (3) No significant variation was observed between evaluations made by two metallographers. (4) A curvilinear regression analysis of data obtained by the grid intercept method indicates that precision as a function of the number of samples satisfied the relationship: Precision ($1\ \sigma$) = $0.0021 + 0.0591\ (1/\sqrt{N})$. (5) Precision obtained by more than one placement of the grid on a photomicrograph is not significantly better than a single placement. (auth)

2724 (NAA-SR-Memo-10209) COMPUTATION OF SURFACE AREA USING RECOMP III. J. Guon (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). July 10, 1964. Contract AT-11-1-GEN-8. 20p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Linearizing equations were derived that correlate the resistance of a self-heating thermistor to the pressure of the gas surrounding it. RECOMP III programs were written to obtain surface area from BET isotherm measurements. (auth)

2725 (NP-14437) CAVITATION DAMAGE TESTS OF STRESSED SPECIMENS WITH MERCURY IN A VENTURI. Technical Report No. 13. Lawrence L. Barinka, Frederick G. Hammitt, M. John Robinson, Robert D. Pehlke, and Clarence A. Siebert (Michigan. Univ., Ann Arbor. Coll. of Engineering). Nov. 1963. 70p. (ORA-03424-13-T)

Cavitation damage tests of stainless steel specimens under tensile stress were conducted in the venturi cavitation damage facility. Specimens were tested in mercury at a throat velocity of 34 ft/sec for 90 hours, and at applied tensile stresses of up to about 1.3 times the tensile yield strength of the material tested, i.e., to about $\frac{2}{3}$ of the ultimate tensile strength. The yield and ultimate strengths of the stainless steel specimens were observed to decrease from damage due to cavitation alone, and for cavitation in combination with an applied tensile stress. The applied stress had only a small effect on the development of cavitation damage but did affect the gross weakening of the test specimens from a given quantity of cavitation damage in terms of mean depth of penetration. (auth)

2726 (ORNL-3684) SOME OBSERVATIONS OF THE INTEGRANULAR CORROSION OF IRRADIATED TYPE 304 STAINLESS STEEL. E. L. Long, Jr., and C. Michelson (Oak Ridge National Lab., Tenn.). Nov. 1964. Contract W-7405-eng-26. 31p. Dep.; $2.00(cy), 1(mn) OTS.

Five prototype instrumented fuel elements for the Experimental Gas-Cooled Reactor were irradiated in the helium-cooled ORR Loop 1 at cladding temperatures to 1500°F and burnups to 0.1 at. % U. These elements contained high-density, sintered UO_2 fuel bushings clad with type 304 stainless steel tubing. During the postirradiation examination of certain of these test elements, some localized intergranular corrosion of the cladding was observed. In addition, extensive intergranular attack of type 304 stainless steel was detected in components operating adjacent to the test element but at lower temperatures (800–1200°F). The observations are discussed, and photographs and photomicrographs of typical corroded areas are given. The observations indicate that storage of sensitized, irradiated type 304 stainless steel in a high-humidity environ-

ment or underwater may lead to extensive intergranular corrosion. (auth)

2727 (ORNL-P-166) TECHNIQUES FOR DEPOSITION AND SYSTEMATIC STUDY OF PROPERTIES OF PYROLYTIC CARBON ON CERAMIC FUEL PARTICLES. R. L. Beatty, J. L. Cook, and F. L. Carlsen, Jr. (Oak Ridge National Lab., Tenn.). [1963]. Contract W-7405-eng-26. 6p. (CONF-654-9). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

A brief description is given of the fluidized-bed coating of carbide and oxide fuel particles with pyrolytic carbon. The variables in the coating process are discussed, particularly the methane partial pressure in the case of UC_2 particles. The structure of the as-deposited coatings is discussed. (D.L.C.)

2728 (PDL-50140) PERFORMANCE ABOVE 1000°F OF SUPERALLOYS AND PROTECTIVE COATINGS. PDC Search No. 63-050. R. G. Lyle and R. C. Peden, comps. (National Research Council. Prevention of Deterioration Center). Dec. 1963. 56p. (AD-601295). $5.60(OTS).

An annotated bibliography is presented with the emphasis on Ni and Co base alloys, although some references on selected Fe and Cr base alloys are also included. Some of the properties covered are oxidation resistance, erosion, corrosion, carburization, mechanical properties, etc. (D.L.C.)

2729 (RT/CHI(64)-8) FISSION PRODUCT RELEASE FROM UO_2 PARTICLES DISPERSED IN A Na MEDIUM. G. J. Segre (Italy. Comitato Nazionale per l'Energia Nucleare, Rome). May 1964. 28p. Dep.(mn).

The recoil and evaporation release phenomena are theoretically examined. A method is set up to calculate by IBM-7094 the fission product production also for short irradiation times; results are reported. Analysis is made of the effect of the open porosities on the release and calculation is reported. The maximum permissible burn-up for uncoated UO_2 particles is studied. Results are reported for various fractional releases vs. material yield stress. (auth)

2730 (SC-R-64-1322) DIFFUSION AND SOLUBILITY OF GASES IN METALS; A SELECTIVE BIBLIOGRAPHY WITH ABSTRACTS. C. Dean, comp. (Sandia Corp., Albuquerque, N. Mex.). May 1, 1964. Contract AT(29-1)-789. 36p. Dep.(mn); $2.00(cy), 1(mn) OTS.

An annotated bibliography of 154 references is presented which is arranged under the following headings: general, permeability and diffusion, sorption, and solubility. An author index is included. (D.L.C.)

2731 (UCRL-11470) THERMODYNAMICS AND HIGH-STRENGTH MATERIALS. Alan W. Searcy and Lies N. Finnie (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley. Coll. of Engineering). Aug. 10, 1964. Contract W-7405-eng-48. 43p. (CONF-710-4). Dep.(mn); $2.00(cy), 1(mn) OTS.

From 2nd International Symposium on Materials, Berkeley, Calif., June 1964.

The thermodynamic implications of Henry's law are analyzed. The use of thermodynamic equations consistent with Henry's law to evaluate and predict the variation with temperature of solubilities of solid and gaseous elements in metals is explored. The effect of a metal solute on the solubility of a nonmetal solute is discussed. The possibility of using vacuum heating to remove hydrogen, oxygen, and nitrogen is briefly analyzed, and the possibility of removing carbon by heating in low pressures of oxygen is considered. (auth)

2732 NEW MATERIALS IN THE NUCLEAR INDUSTRY. Charles R. Johnson (Babcock and Wilcox Co., Alliance, Ohio). Ind. Res., 6: No. 10, 72-6; 78; 80; 82; 84 (Nov. 1964).

The development and properties of materials for use as nuclear fuels, moderators, and controls are discussed. Economics of the materials are also discussed. (P.C.H.)

2733 THE PREPARATION OF CERIUM, PRASEODYMIUM, AND NEODYMIUM HEXABORIDES. G. Bliznakov and P. Peshev (Inst. of General and Inorganic Chemistry, Sofia). J. Less-Common Metals, 7: 441-6(Dec. 1964).

The hexaborides of the first three rare earth metals, cerium, praseodymium, and neodymium, were prepared by the reaction of CeO_2, Pr_6O_{11}, and Nd_2O_3 with elemental B, in vacuum at temperatures of 1200–1800°C according to the following general scheme: $Me_mO_n + (6m + n)B \rightarrow mMeB_6 + nBO$. It was established that products of reaction of the composition close to stoichiometric are obtained at 1700–1800°C. By the borothermic reduction of the oxides, rare earth metals and B_2O_3 are obtained, the latter giving, with the excess of B, volatile boric suboxide. This reaction is an equilibrium process, displaced completely towards BO at high temperatures. The crystal patterns of CeB_6, PrB_6 and NdB_6 were determined with a sharp focusing camera. The values obtained are in very good agreement with the values, given in the literature, for the same products obtained by other methods. (auth)

2734 MATERIALS. Power Reactor Technol., 7: 365-9(1964).

The mechanical properties of the boron–stainless steel alloys used in the control rods of the Pathfinder Reactor are given, and prediction of their in-pile behavior is considered. The use of boron carbide and other boron compounds in dispersions for control rods is discussed. The joining of Zircaloy to stainless steel by tandem extrusion is reviewed, and the irradiation effects on the properties of the resulting joints are described. (D.L.C.)

2735 PROGRESS IN POWDER METALLURGY—1963. VOLUME NINETEEN. Proceedings of the Nineteenth Annual Powder Metallurgy Technical Conference Held at Detroit, April 29, 30, May 1, 1963. Progr. Powder Met., 19: 1-204(1963). New York, Metal Powder Industries Federation, 1963. $15.00.

Twenty-one articles are included; one article was abstracted separately in NSA. The remaining 20 articles include information on powder metallurgy in various industries, treatments on powder metallurgy parts, lubricants for self-lubricating parts, extrusion by powder metallurgy, powder metallurgy in aerospace and composite materials, and porous metal as a heat transfer media. The metal-powder statistical report for 1962-63 is also included. (P.C.H.)

For an abstract of the individual paper see: 2772.

2736 PROGRESS IN POWDER METALLURGY—1964. VOLUME TWENTY. Proceedings of the Twentieth Annual Powder Metallurgy Technical Conference and Magnetic Inductance Core Conference Held at Chicago, Apr. 27, 28, 29, 1964. Progr. Powder Met., 20: 1-333(1964). New York, Metal Powder Industries Federation, 1964. $18.00.

Twenty-seven papers are included; separate abstracts were prepared for 3. One article on production, properties, and working of hot-pressed beryllium billets was previously abstracted in NSA as 18: 34113. The remaining 23 articles include information on powder metallurgy in the appliance industry powder metallurgy of various metals and alloys, powder metallurgy of sintered materials, solving high temperature materials problems by powder metallurgy, mill shapes by powder metallurgy, atom movements during solid state sintering, characteristics of shielded coil assembly, temperature coefficient of permeability of carbonyl–iron powder cores, determination of inductance for toroidal powdered iron cores, toroidal inductors with DC bias, use and manufacture of ferrites, and linear delay line design. (P.C.H.)

For abstracts of individual papers see: 2773, 2774, and 2775.

2737 DEVELOPMENT OF FUEL FOR THE BROOKHAVEN CHEMONUCLEAR IN-PILE RESEARCH LOOP.

Walter D. Tucker, Gerald Farber, and Meyer Steinberg (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 316(Nov. 1964).

2738 FLUORIDE TUNGSTEN. J. H. Oxley (Battelle Memorial Inst., Columbus, Ohio), E. A. Beidler, J. M. Blocher, Jr., C. J. Lyons, R. S. Park, and J. H. Pearson. Trans. Am. Nucl. Soc., 7: 426(Nov. 1964).

2739 RATCHETING GROWTH OF AN ELEMENT SUBJECTED TO PARABOLIC THERMAL CYCLING. David Burgreen (United Nuclear Corp., White Plains, N. Y.). Trans. Am. Nucl. Soc., 7: 436-7(Nov. 1964).

2740 THE BEHAVIOR OF A REFRACTORY METAL WITH REGARD TO FISSION-PRODUCT CONTAINMENT AT HIGH TEMPERATURES. P. K. Conn, H. C. Brassfield, J. D. Elkins, and R. E. Blevins (General Electric Co., Cincinnati). Trans. Am. Nucl. Soc., 7: 453(Nov. 1964).

2741 HIGH TEMPERATURE TECHNOLOGY. Proceedings of an International Symposium Held at Pacific Grove, California, 8-11 September, 1963. International Union of Pure and Applied Chemistry. Published as a Supplement to Pure and Applied Chemistry. Washington, D. C., Butterworths, 1964. 604p. (CONF-135)

Separate abstracts were prepared for 10 of the 24 papers included. Six other papers were previously abstracted for NSA (17: 31981, 41436; 18: 1840, 2286, 6786, and 7253). The remaining papers deal with measurements at high temperature, hyperthermal wind tunnels, high-temperature kinetics and thermodynamics, phase transformations under high pressure and temperature, mechanical properties of two-phase crystalline materials, ablative materials, and materials requirements for space propulsion. (D.C.W.)

For abstracts of individual papers see: 2354, 2507, 2761, 2762, 2850, 2851, 2852, 2942, 3020, and 3444.

2742 THE TECHNOLOGY OF CERAMICS AND REFRACTORIES. P. P. Budnikov. Translation by Scripta Technica. Cambridge, Mass., Massachusetts Institute of Technology, 1964. 653p. $15.00.

Information is included on structural ceramics, refractory materials, and fine ceramics. 167 references. (P.C.H.)

2743 PRODUCTION OF EXTREMELY PURE ZIRCONIUM. Hermann Renner (to Deutsche Gold- und Silber-Scheideanstalt). U. S. Patent 3,147,108. Sept. 1, 1964. Priority date Feb. 22, 1962, Germany.

A process is given for the commercial production of very pure Zr or Hf. The process comprises first forming an alkali metal halozirconate or halohafnate from $ZrCl_4$ or $HfCl_4$, and then reacting the double salt with Mg and/or Na slowly so that the temperature does not rise above 900°C. The reducing metal is preferably a Mg–Na mixture with the Na being the major constituent (~ 80%), as a compact Zr sponge can be formed using such a mixture. An apparatus for carrying out the process is described. (D.L.C.)

Corrosion

Refer also to abstract 3711.

2744 (BMI-X-315) THE CORROSION OF 79-4 (HyMu 80) AND INOR-8 RODS IN ORNL STUDIES OF THE ALUMINUM PROCESS. P. D. Miller, W. N. Stiegelmeyer, and W. K. Boyd (Battelle Memorial Inst., Columbus, Ohio). Oct. 26, 1964. Contract W-7405-eng-92. 16p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Results are summarized of metallographic studies made on HyMu 80 and INOR-8 corrosion rods after they were exposed. The molten salts were $AlF_3–KF–ZrF_4$ and $LiF–NaF–ZrF_4$, and various fluorination and hydrofluorination conditions were studied. The results indicate that HyMu 80 is slightly more corrosion-resistant than INOR-8, and that the Al process salt is slightly less corrosive than that used for dissolving Zr. (D.L.C.)

2745 (CONF-778-3) FACTORS CONTROLLING CHLORIDE STRESS CORROSION OF TYPE 304 STAINLESS STEEL. S. P. Rideout (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.) and R. F. Mittelberg (Du Pont de Nemours (E. I.) & Co. Savannah River Plant, Aiken, S. C.). Oct. 1964. Contract AT(07-2)-1. 34p. Dep.(mn); $2.00(cy), 1(mn) OTS.

From Metals/Materials Congress, Philadelphia, Oct. 1964.

The practical experience and laboratory studies described shows that electrochemical corrosion plays the dominant role in chloride stress corrosion cracking of type 304 stainless steel. Experience has shown that the chloride content of the environment is of little importance if some mechanism exists for concentrating chlorides on the steel surface. The rate at which stress corrosion damage occurs increases with increasing chloride content and corrosiveness of the environment and increasing stress levels. At low stress levels (residual or applied), cracking occurs slowly as chlorides become concentrated and local corrosion cells are generated. Damage to equipment can be prevented or minimized by a conscientious program of inspection and application of inhibiting techniques. The strong influence of pH on cracking behavior in laboratory studies supports the theory that stress corrosion cracking occurs by localized electrochemical corrosion. (auth)

2746 (HW-SA-2333(Rev.)) METHODS FOR EVALUATING CORROSION RESULTING FROM REPEATED CHEMICAL CLEANING. Lyle D. Perrigo (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 11, 1963. Contract AT(45-1)-1350. 18p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A procedure simulating the cyclic filming and defilming resulting from the decontamination of pressurized water-cooled nuclear reactors has been devised to determine the long-term corrosion effects resulting from such operations. Testing is done in a relatively inexpensive, simple loop fabricated from off-the-shelf items. The procedure used in determining latent corrosion effects involves alternating high-temperature operation and chemical cleaning. Determination of serious corrosion problems can be accomplished in 2 to 3 months. In cyclic corrosion testing of an alkaline permanganate-sodium bisulfate process, severe corrosion was found on carbon steel welded to stainless steel. Subsequent testing, using deoxygenated water for rinsing, kept corrosion on weld samples of dissimilar metals to acceptable levels. This testing also demonstrated that loop cleaning could be conducted under essentially oxygen-free conditions. In other testing, severe corrosion through dendritic surface openings and casting voids resulted when alkaline permanganate was not completely removed from Stellite surfaces by flushing. (auth)

2747 (NP-14343(Discussion, Session II)) THE STUDY OF CONTAMINATION BUILD-UP ONTO VARIOUS POLISHED SURFACES, FROM DILUTE SOLUTIONS OF PLUTONIUM, BY MEANS OF AN IN-LINE X-RAY COUNTER. A. Whittaker, J. E. Garnett, and G. G. Green (United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England).

Contamination build-up on polished surfaces of stainless steel, tantalum, titanium, glass, Perspex, PTFE, PCTFE, and polythene, immersed in the flowing condensate from a plutonium evaporator, was investigated. The x-ray counter used to detect uranium L x rays at 17 kev is described. The contamination build-up curve for a glass-walled flow cell was almost constant. Therefore, a prototype in-line x-ray counter with a all-glass cell was designed and built. The calibration curve for the instrument was found to be linear from 0.1 mg/l to 1 g/l. (J.S.R.)

2748 (UCRL-7663) CORROSION OF BERYLLIUM OXIDE BY WATER VAPOR. A. Maimoni (California. Univ., Livermore. Lawrence Radiation Lab.). Sept. 4,

1964. Contract W-7405-eng-48. 35p. Dep.; $2.00(cy), 1(mn) OTS.

The corrosion of BeO tubes by water vapor flowing along the tubes is considered. A method for calculating the weight loss is described together with the IBM-650 code HOT HOLE. Entrance effects are discussed briefly. It is shown that the HOT HOLE results are in reasonable agreement with experimental data. (D.L.C.)

2749 THE ROLE OF IN-PORE MASS TRANSPORT RESISTANCE IN THE REACTION OF POROUS SOLIDS WITH GASES. THE AIR OXIDATION OF LARGE TUBES OF GRAPHITE. P. Hawtin and R. Murdoch (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Chem. Eng. Sci., 19: 819-34(Oct. 1964).

The rate of reaction between a gas and a porous solid at elevated temperatures is limited by in-pore mass transport resistance. A mathematical model is presented that allows the magnitude of this effect to be estimated. The mass transport resistance is considered as three constituent parts, diffusion, bulk flow due to superimposed pressure gradients and bulk flow due to volumetric changes in the chemical reaction. The effect of diffusional resistance is determined on the basis of a free gas model and Knudsen diffusion is not considered. The chemical rate is assumed to obey a simple order relationship with respect to the reactant gas. The theory was verified by a study of the oxidation of large tubes of graphite exposed to air at the bore surface. Evidence of a diffusional effect was obtained from gas concentrations in the bore and at the external surface. The effect of superimposed bulk flow of gas through the graphite was examined. Good agreement between the observed results and those predicted from the theory was obtained at temperatures in the region 400–550°C. The effects on the calculated results of carbon monoxide formation and the concentration dependence of the diffusion coefficient were examined. Under the experimental conditions employed these were found to be of the second order. The commonly assumed first order dependence of the graphite–oxygen reaction was found to be incorrect and support for a 0.6 order dependence obtained. (auth)

2750 AIR OXIDATION OF YTTRIUM AND SOME YTTRIUM-BASE ALLOYS. J. A. Haefling, F. A. Schmidt, and O. N. Carlson (Ames Lab., Ames, Iowa). J. Less-Common Metals, 7: 433-40(Dec. 1964). (IS-939)

An investigation was made of the air oxidation behavior of yttrium metal of 99.9% purity at temperatures between 500 and 1400°C. An oxide layer formed on the metal surface affords excellent protection against oxidation up to about 875°C but this film breaks down at higher temperatures, resulting in complete failure of the specimen within a few days or hours. The effects of those impurities present in commercial grade yttrium upon the oxidation rate between 600 and 900°C were also studied. Fluorine and silicon were found to affect this rate adversely whereas carbon, hydrogen, nitrogen, chromium, iron, nickel, tantalum and titanium have little if any effect. The role of fluorine was studied quite extensively at various temperatures and concentrations in an attempt to determine the reasons for its detrimental effect. (auth)

2751 RADIATION BACKSCATTERING FOR EVALUATION OF METAL CORROSION. Sigmund Berk (Pitman-Dunn Inst. for Research, Philadelphia). Trans. Am. Nucl. Soc., 7: 341-2(Nov. 1964).

2752 DEVELOPMENT OF BETA BACKSCATTER TECHNIQUES FOR EVALUATION OF ANTIOXIDATION COATINGS. M. D. Oestreich and W. E. Loewe (Illinois Inst. of Tech., Chicago). Trans. Am. Nucl. Soc., 7: 342-3(Nov. 1964).

2753 DEVELOPMENT OF A METAL FUEL ALLOY FOR THE SEFOR FAST CRITICAL EXPERIMENT FOR ZPPR. L. R. Kelman, H. V. Rhude, and H. Savage (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 401-2 (Nov. 1964).

2754 OUT-OF-PILE SIMULATION OF INTERGRANULAR CRACKING OF NONSENSITIZED STAINLESS STEEL IN WATER REACTOR ENVIRONMENTS. A. E. Pickett, W. L. Pearl, and M. C. Rowland (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 7: 421(Nov. 1964).

2755 CHLORIDE MIGRATION AND INDUCTION OF STRESS CORROSION CRACKING IN AUSTENITIC STAINLESS STEEL. C. R. Bergen (Allis-Chalmers Mfg. Co., Milwaukee). Trans. Am. Nucl. Soc., 7: 423-4(Nov. 1964).

2756 THE EFFECTS OF REACTOR DECONTAMINATING SOLUTIONS ON INTERGRANULARLY CORRODED TYPE-304 STAINLESS STEEL. A. P. Larrick (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 424(Nov. 1964).

2757 CONTINUOUS ON-REACTOR MEASUREMENT OF INSTANTANEOUS CORROSION RATES. R. B. Richman (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 439(Nov. 1964).

2758 DEVELOPMENT OF CORROSION-RESISTANT NIOBIUM ALLOYS FOR NUCLEAR SUPERHEATERS. R. D. Koester, J. A. De Mastry, A. A. Bauer, and F. A. Rough (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nucl. Soc., 7: 455(Nov. 1964).

2759 ZIRCONIUM ALLOYS IN TERPHENYLS. G. Imarisio (Euratom, Ispra, Italy). Trans. Am. Nucl. Soc., 7: 523-4(Nov. 1964).

2760 THE ROLE OF ZIRCONIUM ALLOYS IN REACTOR DEVELOPMENT. U. Roesler (Siemens-Schuckertwerke AG, [Erlangen, Ger.]). p.82-6 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

Properties of zirconium and its alloys for use in reactors are described. The behavior of the corrosion of Zircaloy alloys in water is shown schematically. Oxide layer formation and hydride precipitation of Zircaloy-2 in steam are shown in graphs and pictures for temperatures between 300 and 440 and for 500°C. (M.C.G.)

2761 GAS-METAL REACTIONS AT HIGH TEMPERATURES. P. Kofstad (Central Inst. for Industrial Research, Oslo). p.161-88 of "High Temperature Technology." Washington, D. C., Butterworths, 1964.

Methods used to study gas-metal reactions are indicated; and the results of observations on gas-metal (particularly oxygen-metal) reactions are discussed, with consideration of appropriate theory. Techniques for improving the resistance of metals to corrosion and oxidation at high temperatures are summarized. 70 references. (D.C.W.)

2762 PROTECTIVE COATING REQUIREMENTS AND RECENT DEVELOPMENTS. O. O. Srp and N. M. Geyer (Air Force Materials Lab., Wright-Patterson AFB, Ohio). p.421-45 of "High Temperature Technology." Washington, D. C., Butterworths, 1964.

The coating requirements for protection of refractory metals against the deteriorative effects (especially oxidation) of high-temperature exposure, particularly in space vehicles, are outlined. The technological status and problems of protective coatings are then reviewed. Coatings for Mo, Nb, Ta, and W are stressed. (D.C.W.)

Fabrication

2763 (AECL-1999) AN ELECTRON MICROSCOPE STUDY OF THE OXIDATION OF SOME ZIRCONIUM ALLOYS IN STEAM. J. H. Chute—B. Cox, ed. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Aug. 1964. 24p. Dep.; $1.00 (AECL).

An electron microscope study has been made of the oxide films formed on zirconium, Zircaloy-2, and Zr–0.5 wt % Cu–0.5 wt % Mo. A thin layer of cubic ZrO_2 was observed on the surface of the oxide under all conditions, and was apparently formed (to a thickness of ~150 Å) during the initial stages of oxidation. The crystallite size of thin oxide films ranged from <100 Å on the Zr–Cu–Mo alloy oxidized

at 400°C to 100 to 200 Å for films formed at 650°C. Examination of specimen surfaces by a replica technique showed the development of cracks in the oxide. (auth)

2764 (DP-199) ULTRASONIC TECHNIQUES APPLIED TO FUEL ELEMENT FABRICATION AND PROCESSING. J. Byron Jones, Carmine F. DePrisco, and John G. Thomas (Aeroprojects, Inc., West Chester, Penna.). Feb. 1957. Contract AT(07-2)-1. 46p. Dep.(mn); $2.00(cy), 1(mn) OTS.

The semiworks model automatic welding machine for attachment of spiral ribs to aluminum tubes was modified to permit attainment of more precise rib-to-tube alignment, elimination of fatigue cracking in the free end of the rib during welding, and achievement of more positive internal tube support by the use of a solid mandrel. Attempts to alleviate rib and tube cracking during welding were generally successful. It was shown that rib cracking could be reduced by using freshly solution-heat-treated 6063 aluminum alloy rib stock. Although tube cracking was not entirely eliminated, it appeared that the problem could be solved by closer control of the ultrasonic welding parameters, alignment, and use of a flat-base rib stock with an outward flare to the rib-base edge. Preliminary work with a continuous ultrasonic welder produced aluminum rib-to-flat-plate welds in the strength range achieved with the spiral welder and at rates two to four times faster. This welding development also promises elimination of the rib and tube cracking problems. Exploratory attempts to repair poorly bonded cladding-to-core fuel element sections by means of ultrasonic welding techniques were unsuccessful under the conditions employed. Stop-off corrosion tinning which resisted a boiling, aerated, distilled-water corrosion environment for 840 hours without failure was achieved on aluminum-clad fuel element sections, although not reproducibly, by consecutive ultrasonic tinning of raw edges and rim-casting with an aluminum–silicon brazing alloy. Ultrasonic cleaning of aluminum tubing proved effective, especially when the ultrasonic treatment was superimposed on the action of "Alconox," an inexpensive commercial cleaning solution. (auth)

2765 (HW-SA-3486) PLUTONIUM-BEARING FUEL ELEMENT WELDING FACILITY. L. C. Lemon (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 27, 1964. Contract AT(45-1)-1350. 10p. (CONF-654-21). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

A 26 ft^3 evacuable type facility for welding Zircaloy-clad plutonium-containing fuel rods in a helium atmosphere has been developed. The stainless steel and safety glass chamber of the facility has a demonstrated capability of routinely producing helium-tight (detection limit 5×10^{-10} standard cm^3/sec) closures and maintaining contamination-free (<500 d/m) welded rod exteriors and chamber surfaces. A special insulated acrylic plastic torch mount permits consistent, low-current arc starting, a difficult feat in pure helium, by directing a superimposed high-frequency current to the thoriated tungsten electrode tip. Over 7000 Zircaloy closures on plutonium-containing fuel elements which had alloy, oxide pellet, or compacted oxide particle cores and were subsequently irradiated with no failures, have been welded in this facility with once-through yields of 98–99.5 percent. Fuel elements containing many tens of kilograms of plutonium, some with ^{240}Pu contents to 30 percent, have been welded in the facility. (auth)

2766 (ORNL-P-128) FABRICATION OF SMALL-DIAMETER ALUMINUM-SHEATHED IRRADIATION CAPSULES. J. D. Sease and A. L. Lotts (Oak Ridge National Lab., Tenn.). July 2, 1964. Contract W-7405-eng-26. 3p. (CONF-654-12). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

The major problem in fabricating small aluminum capsules is the end-closure welds, in which "blowouts" increase with decreasing tube diameter. A fusion-welding method was developed which uses a standard tungsten inert-gas welding torch. Full weld penetration results from a step-type end plug with filler metal, and the "blowout" problem is eliminated by reducing the pressure in the tube. The method is being used to fabricate HFIR target elements. (D.L.C.)

2767 (UCRL-11564) THE KINETICS AND MECHANISM OF FINAL STAGE DENSIFICATION IN THE VACUUM HOT-PRESSING OF FINE-GRAINED ALUMINUM OXIDE (thesis). Ronald C. Rossi (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley. Coll. of Engineering). July 20, 1964. Contract W-7405-eng-48. 39p. Dep.(mn); $2.00(cy), 1(mn) OTS.

The kinetics of the final stage densification of fine-grained aluminum oxide has been studied by vacuum hot-pressing between 1150 and 1350°C and from 2000 to 6000 psi. The kinetics is consistent with the Nabarro-Herring creep model. The activation energy for the final stage densification is 115 kcal/mole which agrees with the activation energy for diffusion of aluminum ions. The experimentally determined activation energy for grain growth is 36 kcal/mole which agrees with the extrinsic activation energy for oxygen diffusion. The densification process takes place by two mechanisms: particle rearrangement and diffusional creep. The extent of densification that takes place in the initial stage depends upon the amount of sliding, fragmentation, and plastic flow that occurs. The final stage of densification takes place by diffusional creep and is controlled by aluminum ion diffusion in the case of aluminum oxide. It has been shown that gases entrapped within pores of the hot-pressed compact will produce end-point porosities. A technique is described to remove adsorbed water when this water is the source of the gas. (auth)

2768 INDUSTRIAL FABRICATION OF FUEL ELEMENTS IN FRANCE. R. Boussard (Commissariat a l'Energie Atomique, Saclay, France). Bull. Inform. A.T.E.N. (Assoc. Tech. Energie Nucl.), No. 48, 49-51 (July-Aug. 1964). (In French)

The technical and economic aspects of the industrial fabrication of fuel elements for reactors of the natural uranium metal–graphite–gas type and the natural uranium oxide–heavy water–gas type are studied. Fabrication of the EL-4 and MTR types are also considered. (J.S.R.)

2769 THE BONDING OF METALS TO URANIUM DIOXIDE. A. Milner and C. R. Tottle (Univ. of Manchester, Eng.). J. Inst. Metals, 93: 48-52(Oct. 1964).

The problem of bonding uranium dioxide to nuclear-fuel-element canning materials, to improve heat transfer without the employment of liquid sodium, was examined. General principles governing the adhesion of solids and the wetting of solids by liquids were studied, with special reference to the differences between metal and oxide surfaces. Practical experience and research in connection with other applications of metal/ceramic bonding indicate that reactive metals such as zirconium and titanium can promote wetting and bonding in otherwise non-wetting systems. The sessile-drop technique was used to assess the tendency of copper–titanium alloys to wet and adhere to uranium dioxide surfaces. Contact-angle and surface-tension data are presented which indicate that at 1100°C addition of ~12% titanium to copper reduces the contact angle with uranium dioxide from ~ 125 to 90°C and increases the work of adhesion from 550 to 1200 $ergs/cm^2$. Surface-tension values obtained for pure copper in contact with uranium dioxide are in good agreement with recently published data. (auth)

2770 SEALING A STAINLESS-STEEL-SHEATHED THERMOCOUPLE INTO A MAGNOX END-CAP. P. M. Knowlson and P. M. Bartle (British Welding Research Assn., Cambridge, Eng.). J. Inst. Metals, 93: 52-6(Oct. 1964).

Techniques were developed for sealing a thermocouple sheath into the Magnox end cap of a fuel element for a Calder-type reactor. Direct brazing proved inadequate for the service temperature of 425°C, and an intermediate metal was required. Resistance welding was used to attach a titanium stud to the Magnox end cap, and a method was de-

veloped for brazing the stainless-steel sheath into the titanium end. Joints were subjected to mechanical testing, vacuum leak tests, and thermal cycling to assess performance under simulated service conditions. This technique is now being extensively used to aid the study of basic aspects of uranium/Magnox fuel-element technology. (auth)

2771 REFINING OF ZIRCONIUM BY ZONE MELTING IN A VERY HIGH STATIC VACUUM. J.-P. Langeron. Mem. Sci. Rev. Met., 61: 637-44(Sept. 1964). (In French)

The design and operation of the installation operating in a very high vacuum are described. A very high degree of refining concerning metal impurities was obtained. The separation of impurities was followed by removal by means of distillation. Oxygen and nitrogen are accumulated at the end of the bar. (auth)

2772 VACUUM SINTERING OF CEMENTED CARBIDES AND REFRACTORY ALLOYS. J. J. Loeffler, K. H. McKee, and R. J. Stuligross (General Electric Co., Detroit). Progr. Powder Met., 19: 174-82(1963).

The sintering of cemented carbides and the hot pressing of refractory metals and alloys are discussed. Some of the metallurgical advantages of vacuum sintering are listed. A typical vacuum hot-pressing setup is illustrated. (P.C.H.)

2773 FABRICATION OF INTERMETALLIC COMPOUNDS BY POWDER METALLURGY. A. James Stonehouse (Brush Beryllium Co., Cleveland). Progr. Powder Met., 20: 125-31(1964).

The fabrication of intermetallic compounds by powder metallurgy, their properties, and uses are discussed. Data on melting point, density, structure, and modulus of rupture for several intermetallic compounds are tabulated. (P.C.H.)

2774 POWDER METALLURGY FOR SUPERALLOYS AND REFRACTORY METALS. A. S. Bufferd (New England Materials Lab., Inc., Medford, Mass.). Progr. Powder Met., 20: 132-8(1964).

The use of powder metallurgy for processing Be, Cr, Mo, Nb, Ta, W, Ni, Co-base alloys, and superalloys is discussed. The use of powder metallurgy processing, wherein powders are pressed, sintered, and extruded, has shown considerable economic advantages over arc melting procedures in terms of a greater recovery of a worked product. New and promising developments in alloy design and process technology are indicated through the use of powder metallurgy. (P.C.H.)

2775 ISOSTATIC PRESSING OF POWDERED MATERIALS. Harry C. Jackson. Progr. Powder Met., 20: 159-67(1964).

The process of isostatic pressing, its advantages, types of equipment used, and applications are discussed. Materials being isostatic pressed are listed. The pumping systems, pressure vessels, hoists, and criteria for equipment selection are described. (P.C.H.)

2776 UO_2–PuO_2 FUEL ELEMENTS FOR THE PLUTONIUM RECYCLE DEMONSTRATION EXPERIMENT. R. E. Sharp, C. A. Burgess, J. R. Hague, and R. J. Lobsinger (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 403(Nov. 1964).

2777 HIGH ENERGY RATE PNEUMATICALLY IMPACTED UO_2–PuO_2 FUELS. D. W. Brite and C. A. Burgess (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 408-9(Nov. 1964).

2778 A PHYSICALLY MIXED AND IMPACTED UO_2–PuO_2 FAST REACTOR FUEL. Stanley Goldsmith, M. D. Freshley, J. B. Burnham, and R. E. Skavdahl (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 409 (Nov. 1964).

2779 FABRICATION OF DRIVER FUEL ELEMENTS CONTAINING RARE EARTH BURNABLE POISONS. C. H. Bean, F. D. McCuaig, and J. H. Handwerk (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 410-11(Nov. 1964).

2780 VAPOR DEPOSITION OF TUNGSTEN–RHENIUM ALLOYS. J. I. Federer and C. F. Leitten, Jr. (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 425(Nov. 1964).

2781 FABRICATION OF TUNGSTEN AND TUNGSTEN-25 RHENIUM TUBING. S. Isserow, J. G. Hunt, and R. G. Jenkins (Textron, Inc., West Concord, Mass.). Trans. Am. Nucl. Soc., 7: 425-6(Nov. 1964).

2782 SIMPLE EXPERIMENTAL TECHNIQUES FOR DEPOSITION OF TUNGSTEN FROM TUNGSTEN HEXACARBONYL. J. C. McGuire (Los Alamos Scientific Lab., N. Mex.). Trans. Am. Nucl. Soc., 7: 426-7(Nov. 1964). (LA-DC-6538)

2783 APPLICATIONS AND PROPERTIES OF THE TUNGSTEN CEMENTATION PROCESS. A. C. Nyce, B. L. Vondra, R. Cline, and L. P. Pepkowitz (Nuclear Materials and Equipment Corp., Apollo, Penna.). Trans. Am. Nucl. Soc., 7: 427-8(Nov. 1964).

2784 FLUIDIZED-BED CHARACTERISTICS IN THE COATING OF NUCLEAR FUEL PARTICLES. R. L. Pilloton and A. L. Lotts (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 429(Nov. 1964).

2785 PYROLYTIC CARBON ON CERAMIC FUEL PARTICLES. R. L. Beatty, J. L. Cook, and F. L. Carlsen, Jr. (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 429-30(Nov. 1964).

2786 FABRICATION OF VANADIUM–20-WT% TITANIUM (TV-20) TUBING FOR NUCLEAR FUEL CLADDING. W. R. Burt, Jr., W. C. Kramer, and R. M. Mayfield (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 430-1(Nov. 1964).

2787 CASTING OF ZIRCALOY–URANIUM CORES FOR HWCTR DRIVER TUBES. W. J. Richmond and S. Isserow (Textron, Inc., West Concord, Mass.). Trans. Am. Nucl. Soc., 7: 435-6(Nov. 1964).

2788 REMOTE ENCAPSULATION OF MEGACURIE AMOUNTS OF COBALT-60. Otto A. Kuhl (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 472 (Nov. 1964).

2789 PLUTONIUM-BEARING FUEL ELEMENT WELDING FACILITY. L. C. Lemon (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 488(Nov. 1964).

2790 METAL-TO-CERAMIC SEALS FOR HIGH TEMPERATURE SERVICE. R. S. Kiwak (Bendix Corp., Southfield, Mich.). Metals Park, Ohio, American Society for Metals, 1964, Technical Report No. P 10-3-64, 24p. $3.00. (CONF-778-2).

From Metals/Materials Congress, Philadelphia, Oct. 1964.

The development of metal-to-ceramic seals for use in thermionic converters at temperatures approaching 1500°C is described. The methods investigated for sealing high purity alumina to refractory metals include brazing, electroforming, electron beam welding, ultrasonic welding, graded composites, and diffusion bonding. Metallizing mixtures containing no constituents that are attacked by cesium were developed. Hermetic graded composite bodies and diffusion seals were fabricated. The best joining method that was evaluated consists of fusing the ceramic to a cermet layer on the refractory metal by melting a suitable eutectic between the mating parts. Hermetic seals were fabricated by this ceramic fusion technique and have withstood heating to 1500°C for several hours and to 1300°C for over 1000 hours, and have retained their vacuum integrity. (auth)

2791 COMPACTS FOR NEUTRONIC SYSTEMS. Joseph E. Burke (to U. S. Atomic Energy Commission). U. S. Patent 3,156,747. Nov. 10, 1964.

A method for producing high-density compacts for neutronic systems is described, which comprises admixing an

active material in the form of a powder of the class consisting of uranium, plutonium, and compounds thereof with a benzene-plasticized hydrocarbon binding material (such as polystyrene) and compressing the resultant mixture with a pressure in excess of 2500 lb/in.^{2} (AEC)

2792 METHOD OF SINTERING CERAMIC SHAPES. William J. O'Leary and Eugene A. Fisher (to U. S. Atomic Energy Commission). U. S. Patent 3,157,718. Nov. 17, 1964.

A method is described for firing elongated ceramic shapes, such as rods, in a horizontal position. The shape is fired in a v-shaped trough which is truncated across the bottom in such a way that, as the green shape shrinks during the firing, it comes to rest equally along the two sides of the trough and along the bottom. Optionally the shape may be weighted from above either by an inverted trough, or by a plurality of rods that nest together as the shape shrinks to its final diameter. (AEC)

Properties and Structure

Refer also to abstracts 2498 and 3476.

2793 (AD-607173) THE STRESS-STRAIN BEHAVIOR OF STRONTIUM ZIRCONATE. Final Technical Report, September 15, 1963–September 15, 1964. J. E. Funk, J. Nemeth, and J. R. Tinklepaugh (New York. State Univ. Coll. of Ceramics, Alfred). Contract NOw-0051-d. 77p. $3.00(OTS).

The mechanical yield of polycrystalline $SrZrO_3$ at room temperature appears to be related to a domain motion or crystal twinning similar to that which takes place in ferroelectric $BaTiO_3$ under an electric stress. This theory was supported by comparing experimentally determined yield to the expected yield from crystallographic considerations. Small single crystals were grown and photographs further revealed a laminar structure taken to be similar to those known to exist in $BaTiO_3$. This further supports the theory presented. (auth)

2794 (APL-TDR-64-116(Pt.I)) MATERIALS INVESTIGATION, SNAP 50/SPUR PROGRAM. PART I. CREEP-RUPTURE PROPERTIES OF STRESS-RELIEVED TZM ALLOY. R. L. Salley and E. A. Kovacevich (Garrett Corp. AiResearch Mfg. Div. of Arizona, Phoenix). Oct. 1964. Contract AF33(657)-10922. 33p. (AD-607274). $3.00(OTS).

The results of experimental investigations to determine the effect of K on the creep-rupture properties of the TZM alloy are presented. The tests were conducted at 1800 and 2000°F, with and without exposure to saturated K vapor. The results indicated that the creep-rupture behavior was not influenced significantly by exposure to K vapor for periods of approximately 1,000 hr. However, some mass-transfer type corrosion was observed. This signifies that it is dangerous to extrapolate the results of this study to 10,000 hours, because progressive mass transfer might eventually cause accelerated creep and premature failure. (auth)

2795 (BM-RI-6553) SOME EFFECTS OF YTTRIUM AND RARE-EARTH-METAL ADDITIONS ON ELECTROREFINED VANADIUM. William L. O'Brien and E. A. Rowe (Bureau of Mines. Albany Metallurgy Research Center, Ore.). June 1964. 26p. Free (Bureau of Mines).

Electrorefined vanadium with additions of up to 5% by weight of yttrium, cerium, lanthanum, praseodymium, neodymium, and samarium was melted to ingots in a nonconsumable electrode arc in a helium atmosphere. The ingots were rolled into strips and evaluated for the effect of the alloying elements on hardness, tensile strength, ductility, recrystallization temperature, and microstructure. Except for samarium, average additions of alloying elements of 1 to 2 wt % resulted in the retention of 0.12 to 1.05 wt % in the alloys and reduced the ultimate tensile strength from about 48,000 to approximately 30,600 psi. The corresponding yield stress (0.2% offset) was reduced from about 40,700 to approximately 20,200 psi. Diamond pyramid hardness (DPH) was reduced from 117 to an average of 62 kg/mm^2. Increased malleability at room temperature resulted with yttrium and all rare-earth-metal additions, except samarium, particularly with more than 0.25 wt % additions. Decreasing oxygen contents corresponded with the changes noted in the mechanical properties of the alloys. The recrystallization temperature of electrorefined vanadium was reduced from approximately 950 to 800°C. Yttrium or a rare-earth-metal content, except samarium, in excess of 0.1 wt % in vanadium produced a second phase suggestive of an eutectic which indicated a possible maximum solubility of less than 0.1 wt % for both room and elevated temperatures. (auth)

2796 (CONF-764-6) THERMAL PROPERTIES OF GRADE CGB GRAPHITE. T. G. Godfrey, J. P. Moore, and D. L. McElroy (Oak Ridge National Lab., Tenn.). [nd]. Contract W-7405-eng-26. 9p. Dep.(mn); $1.00(cy), 1(mn) OTS.

From Thermal Conductivity Conference, San Francisco, Oct. 1964.

The thermal conductivity of CGB graphite, 1.824 g/cm^3, was measured in the radial heat flow apparatus in the range 50 to 900°C in a direction perpendicular to the extrusion direction. The thermal conductivity decreases with increasing temperature following the equation, $1/k = 0.5454 + 12.65 \times 10^{-4}$ T (°K) in cm°K/w, within ±5% at 100°C and ±1% at 900°C. A longitudinal heat flow apparatus was used to measure the thermal conductivity of CGB graphite between 30 and 100°C, parallel and perpendicular to the extrusion direction. The results in the latter direction agreed with the radial heat flow measurements. The results in the parallel direction were nearly twice the results obtained in the perpendicular direction. The electrical resistivity of CGB graphite was measured to 1000°C parallel and perpendicular to the extrusion direction. The theoretical electronic contribution to the total thermal conductivity increases with temperature, but at 1000°C amounts to less than 7% in the perpendicular direction. Thus the vast majority of heat transport in this graphite is due to phonons, whose effectiveness is related to the extrusion direction. (auth)

2797 (CONF-764-9) AN APPARATUS TO MEASURE THE THERMAL CONDUCTIVITY OF POOR CONDUCTORS TO 1000°C. N. N. Engel and D. L. McElroy (Oak Ridge National Lab., Tenn.). [1964]. Contract W-7405-eng-26. 11p. Dep.(mn); $1.00(cy), 1(mn) OTS.

From Thermal Conductivity Conference, San Francisco, Oct. 1964.

A radial heat flow system, which uses a single movable thermocouple to measure the radial temperature distribution, was developed for measuring the thermal conductivity of poor conductors to 1000°C. Initial measurements were completed on a low density thermal insulation (carbon felt, type VDF) in vacuum to 600°C, in air to 300°C, and in helium to 1000°C. The results in vacuum were fitted by an $A + BT^3$ relation, which implies a constant heat transport contribution due to the carbon felt and a T^3 radiation dependence that was only 40% of the calculated exchange expected from radiation in the absence of the specimen. By adding the known thermal conductivities of the two gases to this expression, equations were obtained that represented well the thermal conductivity measured with the two gases present. Thus carbon felt insulation blocks direct radiation transport and gaseous convection, but not gaseous conduction. (auth)

2798 (CONF-764-10) THE THERMAL CONDUCTIVITY OF INCONEL 702. J. P. Moore and W. P. Murray (Oak Ridge National Lab., Tenn.). [1964]. Contract W-7405-eng-26. 7p. Dep.(mn); $1.00(cy), 1(mn) OTS.

From Thermal Conductivity Conference, San Francisco, Oct. 1964.

The thermal conductivity of Inconel 702 was measured in the radial heat flow apparatus in the range 50 to 930°C. Although the thermal conductivity of Inconel 702 increases nearly linearly with temperature, the alloy is subject to at least two complex reactions, age hardening and "K-state" formation, which affect the thermal conductivity. All mea-

surements reported to date in the above temperature range agree to within ±2%, and those for the alloy in the same structural state agree to within ±1%. The thermal conductivity of the solution-annealed alloy was approximately 2% lower than that of the aged alloy. (auth)

2799 (COO-623-101) ELECTRICAL RESISTIVITY OF THIN NICKEL FILMS DEPOSITED IN ULTRA-HIGH VACUUM (thesis). Technical Report No. 33. Richard G. Meyers (Case Inst. of Tech., Cleveland). June 1964. Contract AT(11-1)-623. 36p. Dep.(mn); $2.00(cy), 1(mn) OTS.

The resistivity and temperature derivative of resistivity were determined for thin nickel films deposited and measured in ultra-high vacuum. For annealed films the thickness variation of the resistivity can be accounted for by the Fuchs-Sondheimer theory with completely diffuse surface scattering. The deduced values of bulk resistivity ρ_∞ and bulk mean free path λ at 20°C are $\rho_\infty = 7.6 \times 10^{-6}$ ohm-cm and $\lambda = 300$ Angstroms. The temperature derivative of resistivity is found to be reduced about 6% from the known bulk value for nickel, except for the thinnest films (<100 A) which have higher than bulk values. The reduction is interpreted in terms of differential thermal expansion between film and substrate. (auth)

2800 (GEMP-40A) HIGH-TEMPERATURE MATERIALS PROGRAM PROGRESS REPORT NO. 40, PART A. (General Electric Co. Advanced Technology Services, Cincinnati). Oct. 15, 1964. Contract AT(40-1)-2847. 27p. Dep.; $2.00(cy), 1(mn) OTS.

Modulus-of-rupture measurements at 600, 800, and 1000°C of BeO irradiated at these temperatures indicated that, in terms of the percent change from the unirradiated value, the changes in the elevated-temperature strength of irradiated BeO were comparable to the changes measured at room temperature. Other results reported include data on the elastic constants and strength of unirradiated BeO of the EBOR composition. Krypton-85 concentration profiles were obtained for a sample of Ta resistively heated to 1850°C under glow discharge conditions and a sample not heated under glow discharge conditions. The difference in the profiles indicates that ^{85}Kr diffused into the hot sample during the discharge process. Permeation studies were continued on samples made of arc-cast Ta. The conditions of time at temperature, ^{85}Kr concentration, and Kr gas pressure achieved so far indicate a permeation rate less than 6.5×10^{-12} ml of gas at STP per cm^2 of surface area per mm of wall thickness per cm of Hg pressure per second at temperatures of about 2400°C. X-ray-diffraction analysis of the area of interest in the $UO_2-ThO_2-Y_2O_3$ system showed a complete series of face-centered cubic solid solutions. BeO fuel elements sintered at 1675°C and containing 8.5 to 25 vol % $UO_2-ThO_2-Y_2O_3$ solid solutions lost little or no UO_2 in 2000-hr fuel retention tests at 1200°C in air and He and less than 2% UO_2 in 2000 hr at 1400°C in air. Other fuel elements sintered at 1800°C lost only 0.4 to 0.8% UO_2. Transpiration measurements of fuel loss rates of BeO elements fueled with 25 vol % $UO_2-ThO_2-Y_2O_3$ showed exceptional fuel stability at 1650°C in air. (auth)

2801 (HW-SA-3241) ELASTIC CONSTANTS OF SINGLE-CRYSTAL UO_2 AT 25°C. J. B. Wachtman, Jr., M. L. Wheat (National Bureau of Standards, Washington, D. C.); H. J. Anderson, and J. L. Bates (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 1, 1963. Contract AT(45-1)-1350. 10p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The elastic constants of single crystal UO_2 at 25°C were determined to be $c_{11} = 3.95 \pm (.018)$, $c_{12} = 1.21 \pm (.019)$, and $c_{44} = 0.641 \pm (.0017)$ in units of 10^{12} d/cm^2. The numbers in parentheses are computed standard errors of the corresponding constants based on about 16 measurements of each transit time required in four independent determinations of the set of three elastic constants. (auth)

2802 (NYO-2541-1) STUDY OF HIGH-TEMPERATURE PROPERTIES OF TRANSITION METAL PHOSPHIDES AND RELATED REFRACTORY MATERIALS. Final Report, April 1, 1960–October 31, 1964. Karl A. Gingerich (Pennsylvania State Univ., University Park. Coll. of Science). Contract AT(30-1)-2541. 20p. Dep. (mn); $1.00(cy), 1(mn) OTS.

Summaries are presented of studies the preparation, phase relations, vapor pressure, and physicochemical properties of the phosphides of Ti, Zr, U, Th, and other transition metals. (D.L.C.)

2803 (NYO-2994-2) X-RAY EFFECTS CAUSED BY DEFECTS IN METALS. F. R. L. Schoening and F. Witt (Franklin Inst. Labs. for Research and Development, Philadelphia). Apr. 1964. Contract AT(30-1)-2994. 48p. (F-B1979-2). Dep.(mn); $2.00(cy), 1(mn) OTS.

A method to predict and measure static lattice distortions in Ti as produced by interstitial atoms is described. It is assumed that the metal can be approximated by a continuum having the elastic properties of Ti and that the interaction of the interstitial atom with the crystal lattice can be represented by a set of crossed unequal double forces which act along the principal axes of a cartesian coordinate system in the crystal. The doublets act normal to the surface of a small sphere cut out at the position where the interstitial atom is situated in the crystal, and the basal plane doublets are assumed to be of equal magnitude. The influence of thermal vibrations on the diffracted intensity was measured at room temperature and at liquid N_2 temperature, θ_m (x ray) was determined as a function of the defect concentration. (auth

2804 (TID-21311) REACTIONS IN Al–34 w/o U_3O_8 DISPERSIONS. Final Report. J. D. Fleming, J. W. Johnson, and S. H. Bomar (Georgia Inst. of Tech., Atlanta. Engineering Experiment Station). July 1, 1964. Contract AT(40-1)-2483. 82p. Dep.(mn); $3.00(cy), 2(mn) OTS.

Attempts were made to determine the reaction kinetics in dispersions of approximately 34 wt % U_3O_8 in aluminum heated above the melting point of aluminum. Techniques employed included differential thermal analysis, dynamic high temperature x-ray diffraction, and post-heating chemical analysis. Reduction of the U_3O_8 was found to proceed in two stages, an early rapid reduction to UO_2 and a later slow reduction of the UO_2 to U–Al solution. None of the experimental techniques proved fast enough to reveal the kinetics of the rapid reduction to UO_2. During this rapid reaction, approximately 15 per cent of the U_3O_8 was reduced to U–Al solution and approximately 65 per cent of the U_3O_8 was reduced to UO_2 when the dispersion was heated, over a time of approximately two minutes, from 1300 to 2000°F. Most of the reaction appeared to occur between 1700 and 1800°F. Following this initial reaction, further U_3O_8 reduction occurred at a rate estimated to be approximately 2 to 8 per cent per minute. During the early rapid reaction, the calculated energy release was approximately 100 to 200 kcal per kg of U_3O_8. During the subsequent slower reaction, the energy release rate was estimated to be 10 to 40 kcal per minute per kg of U_3O_8. A brief study was made of the deformation under load of a dispersion of approximately 34 wt % U_3O_8 in aluminum at temperatures above the melting point of aluminum. Below 1800°F, approximately 1 psi static transverse pressure differential was required to produce gross deformation in the molten dispersion when the specimen thickness was approximately 90 mils. The deformation proceeded by exudation of oxide-free alloy from the dispersion. The load required to produce deformation did not vary significantly from 1350 to 1710°F. At 1860°F, the specimen reacted essentially completely before pressure application and deformation did not occur under a pressure differential of 4 psi, the maximum obtainable in the test apparatus. (auth)

2805 (TID-21312) FUSED SILICA MANUAL. Final Report, November 14, 1958–July 1, 1964. J. D. Fleming (Georgia Inst. of Tech., Atlanta. Engineering Experiment Station). Sept. 1, 1964. Contract AT(40-1)-2483. 189p. Dep.(mn); $5.00(cy), 3(mn) OTS.

Engineering data on the properties of fused silica are presented for use in its evaluation for structural applications. Emphasis is placed on mechanical behavior and

environmental response (radiation and chemical resistance). Fabrication by glass working, pressing, and slip casting is discussed. (D.L.C.)

2806 (UCRL-11239) NEGATIVE CLIMB OF PRISMATIC DISLOCATION LOOPS IN Al–7.2 At. % Mg ALLOY. A. Eikum and G. Thomas (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley). Feb. 1964. Contract W-7405-eng-48. 4p. (CONF-806-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 3rd European Regional Conference on Electron Microscopy, Prague, Aug.-Sept. 1964.

Negative climb (shrinking) of prismatic dislocation loops was studied for various quenched and aged thin foils of Al–7.2 at. % Mg alloys. From a shrinkage rate vs 1/T graph, the activation energy for negative climb was determined to be $E_{(-C)} = 0.68$ ev with a pre-exponential constant $A = 2.0 \times 10^{-6}$ cm²/sec. The factors governing growth and shrinkage processes are discussed. It is suggested that shrinkage involves the breakdown of the Mg-vacancy association at the loop followed by vacancy migration to the active sinks. (D.L.C.)

2807 (UCRL-11671) EFFECT OF IMPURITIES ON THE RHEOLOGY OF TWO KAOLINS. R. B. Langston, E. A. Jenne, and J. A. Pask (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley. Coll. of Engineering). Oct. 13, 1964. Contract W-7405-eng-48. 29p. (CONF-770-2). Dep.(mn); $2.00(cy), 1(mn) OTS.

From Proceedings of the Clay Mineral Society, Madison, Wis., Oct. 1964.

Two kaolins were given five successive processing steps so as to remove a number of impurities. These processing steps were designed to accomplish the following objectives: (1) removal of nonclay and soluble fractions; (2) removal of organic material; (3) removal of iron oxides; (4) removal of allophane; and (5) removal of three-layer lattice minerals. After each of these steps, consistency curves were obtained for each of the clays at both 6.5 and 9.0 pH on slurries containing up to 50 weight percent solids. Yield point, plastic viscosity, and apparent viscosity at 250 sec^{-1} values were calculated. These rheological data were supplemented with chemical analyses, photomicrographs, x-ray and D.T.A. evaluations. The effect that some impurities have on the rheological properties of these kaolins is discussed. (auth)

2808 (UCRL-12003) PREPARATION AND CHARACTERIZATION OF HIGH-PURITY THORIUM DICARBIDE. N. D. Stout (California. Univ., Livermore. Lawrence Radiation Lab.). Sept. 16, 1964. Contract W-7405-eng-48. 9p. Dep.; $1.00(cy), 1(mn) OTS.

Relatively pure thorium dicarbide was prepared by arc melting and characterized by metallographic and x-ray techniques. The samples were prepared with a slight deficiency of C ($ThC_{1.93}$) and with an average O_2 content of 580 ppm. The following lattice parameters were calculated: a = 8.254 A, b = 4.217 A, c = 10.553 A, and $\beta = 90.65°$. A highly twinned structure was found, with two samples of high tungsten content showing finer grain structure than low-tungsten samples. (D.L.C.)

2809 (JPRS-27097) EXPERIMENTAL TECHNIQUES IN THE INVESTIGATION OF CARBON–GRAPHITE MATERIALS AT 20-3200°C. N. N. Dergunov and V. N. Barabanov. Translated from Zavodsk. Lab., [30]: 997-1005(Aug. 1964). 19p. (TT-64-51353). $1.00(OTS).

Results of a survey of information concerning the mechanical properties of carbon–graphite materials at high temperatures are presented. Information is included on specimen heating methods, measurement and adjustment of temperature, and stress and deformation measurements. (J.R.D.)

2810 STRESS RELAXATION PRIOR TO THE YIELD POINT IN NIOBIUM AND MOLYBDENUM. B. J. Shaw and G. A. Sargent (Mellon Inst., Pittsburgh). Acta Met., 12: 1225-30(Nov. 1964).

Stress relaxation, i.e. the drop in load due to plastic flow at constant strain, was used as a technique to study the phenomenon of plastic strain in the pre-yield region of the load–elongation curve. Results from experiments on niobium and molybdenum were interpreted to mean that at room temperature some dislocations are free to move at very low stresses. The amount of plastic strain due to the movement of these free dislocations at any given stress level, below the upper yield stress, was found to be a function of loading-rate. The movement of the free dislocations was inhibited by the presence of interstitial impurity atoms, defects produced by irradiation damage and by debris and dislocation tangles produced by cold work. It was also concluded that the defects produced by irradiation damage, which anneal out in the temperature range 140–200°C, form clusters on annealing rather than condensing onto dislocation lines. It was inferred from these experiments that the yield point phenomenon results from dislocation multiplication rather than unpinning from impurity atmospheres. (auth)

2811 THE MECHANISM OF DIFFUSION IN ANOMALOUS B.C.C. TRANSITION METALS. G. B. Gibbs (Central Electricity Generating Board, Berkeley, Glos., Eng.). Acta Met., 12: 1302-3(Nov. 1964).

Evidence that diffusion in Ti, Zr, and U occurs entirely through equilibrium vacancy-atom exchange is reviewed. Basic features of a model that was developed to account for the unusual values of Q and D_0 are also mentioned. (P.C.H.)

2812 A STUDY OF SULFUR DIFFUSION INTO CERTAIN HIGH MELTING METALS. M. M. Pavlyuchenko and I. F. Kononyuk. Dokl. Akad. Nauk Belorussk. SSR, 8: 157-60(1964).

The diffusion of sulfur into high-melting metals was studied. ^{35}S was coated on the test metal, either in a thin layer that established an unsteady diffusion source, or in a relatively thick layer (~5 microns) for a constant source. After heating at 700 to 1250°C, a layer-by-layer radiometric analysis of the sample was conducted. In cobalt (99.99% pure) the diffusion at 700 to 900°C was almost exclusively along grain boundaries, but above 1000°C volume diffusion also occurred. At 1150 to 1250°C sulfur distribution from a thin layer was uniform through the sample, while from the thick layer it was concentrated along boundaries at certain places. The sulfur concentration (I) was studied as a function of the diffusion depth (x). For both steady and unsteady diffusion sources on cobalt a plot of $\log I = f(x^2)$ is linear, and its slope determined the volume diffusion coefficient D. The relation between D and the temperature was $D = 1.3 \exp(-5400/RT)$ cm²/sec. Nickel diffusing into chromium showed a similar effect. Cobalt annealed at 1000 to 1100°C gave a linear plot $\log I = f(x)$. From this slope the product of the intercrystalline layer width σ and corresponding boundary diffusion coefficient D_{bd} was determined. The temperature dependence of σD_{bd} in cobalt is $\sigma D_{bd} = 3.2 \cdot 10^3 \exp(-50000/RT)$ cm³/sec. At 800 to 900°C in cobalt $\log I = f(x^2)$ is linear, and the slope gives an intercrystalline diffusion coefficient $(8-10) \times 10^{-10}$ cm²/sec. In both nickel and cobalt the diffusion depth at 700°C is small. At 800 to 850°C it is larger than at 900 to 1000°C, but above 1000°C increases again. The diffusion in chromium and molybdenum becomes apparent above 1000°C and in tungsten at 1100 to 1200°C, where volume diffusion accompanies boundary diffusion. The solubility of sulfur in several metals is in the range 0.01 to 0.001%. (TCO)

2813 DISPERSION RELATION OF ELECTRON AND ION PLASMA IN SOLIDS. Krunoslav Ljolje (Univ. of Sarajevo, Yugoslavia) and Vladimir Šips. Glasnik Mat.-Fiz. Astron., Ser. II, 18: 285-302(1963).

The equation-of-motion method is used to obtain the dispersion relations for the collective motion of electrons and ions in solids, taking into account the oscillations of ions about their equilibrium positions. The longitudinal hamiltonian of the system is derived using second quantization and series expansions of the electronic wave functions. A set of normal variables is then found for the electrons and ions, from which the dispersion relations

follow. The application of the results to the long-wavelength limit, taking into consideration only the valence electrons, is described. (T.F.H.)

2814 MAGNETIC CHARACTERISTICS OF LANTHANIDE–SILVER COMPOUNDS HAVING THE CsCl STRUCTURE. R. E. Walline and W. E. Wallace (Univ. of Pittsburgh). J. Chem. Phys., 41: 3285-8(Dec. 1, 1964).

The magnetic characteristics of 11 intermetallic compounds represented by the formula LnAg are reported for temperatures between 2 and 300°K. YAg is a Pauli paramagnet. CeAg and PrAg are ferromagnets with Curie temperatures 9 and 14°K, respectively. The compounds with Ln = Nd, Sm, Tb, Dy, Ho, Er, or Tm exhibit pronounced susceptibility peaks, from which it is inferred that they are antiferromagnetic at low temperatures. This may also be true for GdAg whose susceptibility behavior is anomalous below 200°K. At the upper temperatures studied Curie-Weiss behavior was observed, and effective moments in good agreement with the free tripositive ion moments were obtained for all except YAg, SmAg, GdAg, and ErAg. The lack of compliance for SmAg was ascribed to limitations in the experimental procedure used. GdAg obeys the Curie-Weiss Law above 200°K, but with an effective moment of 8.57 μ_B. The effective moment observed for ErAg varies from about 9 μ_B at 298° to 6 μ_B at 77°K. (auth)

2815 ZIRCONIUM-HYDRIDE FORMATION IN HOMOGENIZED MAGNESIUM–ZIRCONIUM ALLOY. J. E. Harris and P. G. Partridge (Central Electricity Generating Board, Gloucestershire, Eng.). J. Inst. Metals, 93: 15-18(Sept. 1964).

A study was made of the structure of homogenized (96 hr in carbon dioxide at 600°C) and hydrided (10 min in hydrogen at 600°C) magnesium–0.6 wt.% zirconium alloy. Grain boundaries, cell boundaries, and individual dislocations are preferred nucleation sites for the ϵ-zirconium hydride phase. Hydride precipitation during creep was also investigated, and it was concluded that such precipitation impedes slip creep until eventually directional diffusion creep becomes the dominant deformation mode. (auth)

2816 THE METALLURGY OF TRAINING AND DEGRADATION IN SUPERCONDUCTING ALLOYS OF NIOBIUM. J. R. Moon and J. J. Stobo (International Research and Development Co., Ltd., Newcastle-upon-Tyne, Eng.). J. Inst. Metals, 93: 61-2(Oct. 1964).

Observations in terms of metallurgical inhomogeneities in superconducting wires of materials such as niobium alloys are discussed. Cases in which no training or degradation would be observed are illustrated. (P.C.H.)

2817 EFFECT OF IRON IMPURITY ON THE MAGNETIC SUSCEPTIBILITY OF GADOLINIUM AT ELEVATED TEMPERATURES. S. Arajs and R. V. Colvin (United States Steel Corp., Monroeville, Penna.). J. Less-Common Metals, 7: 336-40(Nov. 1964).

Magnetic susceptibility of various gadolinium samples of different purities was studied above 300°K as a function of temperature. All the samples, including those studied earlier, exhibit an anomaly in the magnetic susceptibility at about 800°K. It is suggested that this behavior results primarily from the ferromagnetic properties of Fe_2Gd which is present as an impurity. This inference is supported by susceptibility data on a sample of gadolinium doped with 0.5 wt. % of iron. (auth)

2818 THE SYSTEM CERIUM–MANGANESE IN THE RANGE OF 0-20 ATOMIC PER CENT MANGANESE. B. J. Thamer (Los Alamos Scientific Lab., N. Mex.). J. Less-Common Metals, 7: 341-6(Nov. 1964). (LADC-6358)

The cerium-rich part of the system cerium-manganese was studied between 500 and 800°C by differential thermal analysis augmented by metallography and an x-ray identification of the phases. No compounds were detected. The eutectic was at 16.1 ± 0.5 at. % manganese and 622°C. The cerium side of the eutectic showed an invariant effect at 638°C at which temperature measurements indicated the following phases to coexist: liquid of 14 ± 1 at. % manganese, delta cerium containing 5 ± 1 at. % manganese, and gamma cerium containing 2 ± 1 at. % manganese. Cooling curves with compositions on the manganese side of the eutectic showed a separate thermal effect at 625°C, but the source of this effect was not clearly determined. (auth)

2819 GRAIN REFINEMENT AND IMPROVED DUCTILITY IN MOLYBDENUM BY SMALL BORON ADDITIONS. A. D. Zumbrunnen and J. M. Fitzpatrick (Fansteel Metallurgical Corp., Richmond, Calif.). J. Less-Common Metals, 7: 356-67(Nov. 1964).

The ductility of electron-beam-melted ingots of molybdenum was greatly improved by the addition of small amounts of boron. Ingots containing boron in concentrations ranging from 10 to 500 ppm by weight were sufficiently ductile that they could be directly forged at temperatures of 2200–2400°F (1204–1316°C) without cracking, a result heretofore unattainable with molybdenum castings of commercial purity. Improved forgeability is related to the fine grain structure brought about by the boron. Grain refinement in castings was evident at boron contents of 10 ppm or less. Significant further grain refinement was achieved by boron additions up to about 230 ppm. Additions in excess of 230 ppm boron produced little further grain refinement. Sheet material was produced from experimental forgings containing boron and subjected to various mechanical tests. Ductility in sheet was greatest at boron levels between 60 and 230 ppm. Tensile strength and recrystallization temperature were equivalent to those reported for commercial unalloyed molybdenum. The stress-rupture strength of molybdenum containing small amounts of boron was substantially above that reported for commercial unalloyed molybdenum and roughly twice that of high purity electron-beam-melted molybdenum. Boron in amounts greater than 230 ppm appears to cause embrittlement in finished sheet. (auth)

2820 PHASE RELATIONSHIPS OF THE OXYGEN-CONTAINING 20 AND 25 PERCENT ZIRCONIUM–NIOBIUM ALLOYS. V. C. Marcotte, W. L. Larsen, and D. E. Williams (Ames Lab., Ames, Iowa). J. Less-Common Metals, 7: 373-82(Nov. 1964). (IS-891)

The oxygen addition mechanism of the 20 and 25 at. % zirconium–niobium alloys was studied at 1000, 1100, and 1200°C. The high-temperature oxygen-solubility limit was found to be less than 100 ppm (0.05 at. %) and essentially temperature-independent. As the solubility limit is exceeded, the equilibrium phase which formed was identified as oxygen-saturated α-zirconium. (auth)

2821 THE EFFECT OF POROSITY AND PORE INTERCONNECTION ON THE THERMAL CONDUCTIVITY AND ELECTRICAL RESISTIVITY OF TUNGSTEN. G. L. Kulcinski, P. Wagner, and L. R. Cowder (Los Alamos Scientific Lab., N. Mex.). J. Less-Common Metals, 7: 383-92 (Nov. 1964). (LADC-6454)

Measurements of the thermal conductivity and electric resistivity of porous tungsten at room temperature are reported. The resistivity was found to vary with porosity, P, according to the equation $\rho = 29.9P^2 + 10.2P + 5.57$. The conductivity varied as $k = 0.127P^2 - 0.64P + 0.409$. It is shown that the reduced conductivity and reduced resistivity are dependent on the degree of pore interconnection. The results appear to conform to Euler's theory on the effect of porosity material constants. The Wiedeman–Franz relationship was found to apply with the experimental results satisfying the equation $k = 0.58 \cdot 10^{-2}T/\rho + 0.10$. (auth)

2822 LATTICE STRUCTURE OF β-Ta_2O_5. K. Lehovec (Sprague Electric Co., North Adams, Mass.). J. Less-Common Metals, 7: 397-410(Dec. 1964).

The x-ray diffraction lines of β-Ta_2O_5 of relative intensities $I > 4$ indicate an orthorhombic unit cell of the dimensions a = 6.20, b = 3.66, and c = 3.89 Å with tantalum atoms near the positions (0,0,0) (1/2, 1/2, 0), two oxygen atoms at about (0,0,1/2) (1/2, 1/2, 1/2) and the other three oxygen atoms in the plane $z \neq 0$ of the tantalum atoms. The average deviations of the tantalum atoms from the positions above are $\alpha = 0.04$ $\beta = 0.03$, and $\gamma = 0.03$. The arrangement of the tantalum atoms, and that of the oxygen atoms in the plane

z = 1/2, is almost hexagonal (a/b = 1.69 vs $\sqrt{3}$ = 1.73) as might be expected from strong electrostatic repulsion forces among the tantalum atoms in the plane z = 0 and among the oxygen atoms in the plane z = 1/2. Presence of many weak lines of relative intensities I ≤ 4 indicates a complicated superlattice structure which has not been fully elucidated. This structure and the distortion from hexagonality appear to result from the difficulties of accommodating three oxygen atoms per two tantalum atoms in the z = 0 plane.

2823 FORMATION AND PROPERTIES OF THORIUM PEROXIDE. R. A. Hasty and J. E. Boggs (Univ. of Texas, Austin). J. Less-Common Metals, 7: 447-52(Dec. 1964).

The initial gelatinous product of the reaction between hydrogen peroxide and aqueous thorium chloride solution has a fixed peroxidic oxygen-to-thorium atom ratio of five to three and a variable initial chloride ion content of 0.3-0.5 chloride ions per thorium. The compound does not hydrolyze and is stable in the presence of liquid water, but decomposes with loss of active oxygen if it is dried at room temperature. Conductometric titrations indicate that the formation reaction proceeds by a combination of replacement of hydroxyl groups from the initial hydrolyzed thorium ion and direct addition of peroxidic anions. (auth)

2824 INTERNAL FRICTION PEAKS CAUSED BY DEFORMATION IN Ta AND Nb. E. de Lamotte and C. Wert (Univ. of Illinois, [Urbana]). J. Phys. Soc. Japan, 19: 1560-4(Sept. 1964).

Internal friction peaks which arise in Ta and Nb after cold working were observed at temperatures between 200 and 300°C for a frequency of 1 cps. Numerous similarities of the peak in Ta to one reported by Schoeck and Mondino were noted, but some differences were also observed. The peaks in both metals anneal rapidly at their maxima. The peaks may be caused by an oxygen-dislocation interaction, as suggested by Schoeck and Mondino; but several differences between these peaks and other cold-work peaks make this assignment uncertain. (auth)

2825 POLYSTYRENE SCINTILLATORS USED FOR GAMMA-RAY DOSE-RATE MEASUREMENTS. W. Stolz and J. Fietz (Technische Universität, Dresden). Kernenergie, 7: 669-74(Sept. 1964). (In German)

Polystyrene scintillators with luminescent additions of p-terphenyl, 2,5-diphenyloxazole, 2-phenyl-5-(4-biphenylyl)-1,3,4-oxadiazol, 2,2'-p-phenylenebis(5-phenyl)-oxazole, and tributyl phosphate were studied for proving their suitability for gamma-ray instantaneous dosimetry. Measurements of the fluorescence intensity of binary and ternary scintillators, of the fluorescence spectra, and of the temperature behavior are described. In the low-energy range the energy dependence was corrected by increasing the effective atomic number by insertion of mercury diphenyl, iodine biphenyl, or ZnS(Ag). High gamma dose irradiation resulted in diminishing the fluorescent yield of the polystyrene scintillators. (auth)

2826 THE RADIOACTIVITY OF GLASSES AND GLASS SOLDERS. K. Matauschek (VEB Vakutronik WIB, Dresden). Kernenergie, 7: 677-80(Sept. 1964). (In German)

The radioactivity of some glasses and glass solders was measured by means of a windowless gas flow counter, in some cases using additional absorber foils in some cases. During the measurements of lead-bearing solders, beta particles and also alpha particles could be detected. The activity of the lead-free glasses came from ^{40}K radiation only, whereas in lead-containing materials ^{210}Pb and its daughter products may increase their self-activity. (auth)

2827 INTERNAL FRICTION AND YOUNG'S MODULUS OF COLD-WORKED ZIRCONIUM. A. I. Dashkovskii, A. N. Semenikhin, and P. L. Gruzin. Met. i Metalloved. Chistykh Metal., Sb. Nauchn. Rabot, No. 4, 41-6(1963).

At −60 to −70°C, 99.8% pure iodide zirconium cylinders (4 × 5 × 100 mm) showed marked relaxation of Young's modulus, accompanied by a peak (Borodini peak) in the values for internal friction. Various parameters influencing the height and location of the Borodini peak and Young's modulus were found. Thus, annealing of cold-worked specimens moves the Borodini peak toward lower temperatures; the degree of cold working influences peak height; annealed specimens of micrograin structure show a higher peak of internal friction and lesser dislocation of Young's modulus than specimens with coarse grain; alloying elements markedly decrease the peak and 1% Nb or 1% Th eliminate the peak; irradiation at 10^{16} neutrons/cm^2 markedly decreases the peak. A relationship between internal friction, activation energy of relaxation, and temperature was derived. (OTS)

2828 NORMAL MODES OF VIBRATION IN NICKEL. R. J. Birgeneau, J. Cordes, G. Dolling, and A. D. B. Woods (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev., 136: A1359-65(Nov. 30, 1964).

The frequency-wave-vector dispersion relation, $\nu(q)$, for the normal vibrations of a nickel single crystal at 296°K has been measured for the $[00\zeta]$, $[0\zeta\zeta]$, $[\zeta\zeta\zeta]$, and $[0\zeta 1]$ symmetric directions using inelastic neutron scattering. The results can be described in terms of the Born–von Kármán theory of lattice dynamics with interactions out to fourth-nearest neighbors. The shapes of the dispersion curves are very similar to those of copper, the normal mode frequencies in nickel being about 1.24 times the corresponding frequencies in copper. The fourth-neighbor model was used to calculate the frequency distribution function $g(\nu)$ and related thermodynamic properties. (auth)

2829 FERROMAGNETISM IN DILUTE SOLUTIONS OF GADOLINIUM IN PALLADIUM. J. Crangle (Univ. of Sheffield, Eng.). Phys. Rev. Letters, 13: 569-70(Nov. 9, 1964).

The magnetizations of Pd–Gd alloys containing up to 9.7 at. % Gd were measured as a function of magnetic field strength at constant temperatures from 1.7 to 80.7°K, and the Curie points and Gd magnetic moments were determined. The variation of the Curie points and magnetic moment per Gd atom with Gd content was also obtained. The results indicate that normal ferromagnetism persists down to Gd contents of less than 1 at. %, indicating long-range interaction between the Gd atoms. In all the alloys the observed moment per Gd atom was notably smaller than the 7 Bohr magnetons usually associated with Gd atoms. The Curie points were also lower than those in Pd–Fe and Pd–Co alloys. An explanation for the observations is given. (D.C.W.)

2830 THERMAL AND DILATOMETRIC EFFECTS DURING ANNEALING OF DEFORMED ZIRCONIUM. B. F. Slyusar. Sb. Nauchn. Rabot Inst. Metallofiz., Akad. Nauk Ukr. SSR, No. 17, 68-71(1963).

The processes that occur during the annealing of deformed iodized Zr were investigated. To determine the absorbed energy of deformation, a differential calorimeter was used. To evaluate the defects formed in zirconium during deformation, the dilatometric method was used. An analysis of the data showed that the total absorbed energy of Zr is fairly high for comparatively low levels of deformation. This phenomenon could be explained by the fact that at temperatures below 865°C, Zr has a hexagonal structure and, because of this, has only one sliding surface, the base plane. As a result, Zr is deformed less readily than metals with a cubic structure. The levels of deformation of Zr achieved during the study were high and the accumulation of energy was considerable. The liberation of absorbed energy during tempering of the sample deformed to 15% showed a relative maximum at 350°C and an absolute maximum at approximately 620°C. The first maximum is probably connected with liberation during recovery; the second, with the process of recrystallization. Increasing the degree of deformation to 30%, the second maximum occurs at 550°C. The examination of Mg and Ti showed approximately the same effects. The absorbed energy of deformation of Ti was also found to be high. (OTS)

2831 THE PROPERTIES OF NICKEL–THORIA ALLOYS. V. A. Tracey (International Nickel Co. (Mond) Ltd., Birmingham, Eng.). Schweiz. Arch. Angew. Wiss. Tech., 30: 213-23(July 1964).

The range of properties that can be obtained from nickel-thoria systems containing 2½ and 5 vol % thoria, prepared by mechanical mixing of powders, are reported. The properties reported (stress-rupture, tensile, impact, fatigue, and thermal shock) are for material produced by extrusion. In addition, data are presented to show the substantial increase in strength that can be obtained by cold-working the extruded material. (P.C.H.)

2832 COMPATIBILITY OF UO_2-TUNGSTEN THERMIONIC EMITTERS IN EX-REACTOR CONVERTER ENVIRONMENT. J. E. VanHoomissen and A. I. Kaznoff (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 7: 376(Nov. 1964).

2833 URANIUM DIOXIDE THERMAL CONDUCTIVITY. J. A. Christensen, A. J. Bush, H. M. Ferrari, and R. J. Allio (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 391-2(Nov. 1964).

2834 THERMAL CONDUCTIVITY OF STOICHIOMETRIC AND HYPOSTOICHIOMETRIC URANIUM OXIDE AT HIGH TEMPERATURES. F. J. Hetzler and E. L. Zebroski (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 7: 392(Nov. 1964).

2835 TEMPERATURE AND STOICHIOMETRY EFFECTS ON UO_2 FUEL HEAT RATINGS. J. A. Christensen (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 392-3(Nov. 1964).

2836 DIFFUSION OF PLUTONIUM AND URANIUM IN OXIDE FUEL AT 2400°C. J. H. Davies and P. E. Novak (General Electric Corp., San Jose, Calif.). Trans. Am. Nucl. Soc., 7: 393-4(Nov. 1964).

2837 PHASE RELATIONS IN THE PLUTONIUM–BORON SYSTEM. R. E. Skavdahl, T. D. Chikalla, and C. E. McNeilly (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 403-4(Nov. 1964).

2838 PROPERTIES OF URANIUM–PLUTONIUM–FIZZIUM ALLOYS. R. J. Dunworth, L. R. Kelman, H. Savage, E. R. Gilbert, and H. V. Rhude (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 405-6(Nov. 1964).

2839 COMPATIBILITY OF U–Pu–FIZZIUM FUEL ALLOYS WITH VANADIUM AND VANADIUM–TITANIUM CLADDINGS. C. M. Walter and J. A. Lahti (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 406-7 (Nov. 1964).

2840 THORIUM AND THORIUM–URANIUM COMPOUNDS AS POTENTIAL THERMAL BREEDER FUELS. N. M. Griesenauer, M. S. Farkas, and F. A. Rough (Battelle Memorial Inst., Columbus, Ohio). Trans. Am. Nucl. Soc., 7: 412(Nov. 1964).

2841 MICROPROBE EXAMINATION OF THERMALLY INDUCED REACTIONS IN NUCLEAR FUEL MATERIALS. W. F. Zelezny (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 7: 412-14(Nov. 1964).

2842 USE OF GAMMA-RAY SHIELDING TECHNIQUES FOR EVALUATING THE MATRIX HOMOGENEITY OF REACTOR FUEL ELEMENTS CONTAINING MATERIALS WITH SIMILAR ATOMIC NUMBERS. Samuel J. Senatore (Oak Ridge Gaseous Diffusion Plant, Tenn.). Trans. Am. Nucl. Soc., 7: 414-15(Nov. 1964).

2843 GRAIN-GROWTH CHARACTERISTICS OF VAPOR-DEPOSITED TUNGSTEN AT TEMPERATURES UP TO 2500°C. A. F. Weinberg, N. B. Elsner, R. G. Mills, and J. R. Lindgren (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 427 (Nov. 1964).

2844 CONSTRUCTION MATERIALS FOR MOLTEN SALT REACTORS. A. Taboada, W. H. Cook, and P. Patriarca (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 438-9(Nov. 1964).

2845 HIGH-TEMPERATURE THERMAL-STRESS LIMITS OF ALUMINA AND BERYLLIA AS POTENTIAL CLADDING MATERIALS FOR REACTOR FUEL ELEMENTS. J. Gilbertson, D. P. Hines, and E. L. Zebroski (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 7: 453-4(Nov. 1964).

2846 FATIGUE NOTCH SENSITIVITY OF ZIRCALOY WELD METAL. W. J. O'Donnell (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 454-5(Nov. 1964).

2847 SAP—FABRICATION AND STRUCTURE DEVELOPMENT. P. Bonnet and P. Jehenson (Euratom, Ispra, Italy). Trans. Am. Nucl. Soc., 7: 522-3(Nov. 1964).

2848 STUDIES ON THE REACTION OF THORIUM WITH GRAPHITE AT HIGH TEMPERATURES. Sakae Takeuchi, Toshio Honma, and Tsuneo Satow (Tohoku Univ., Sendai). Trans. Japan Inst. Metals, 5: 105-10(Apr. 1964).

The reaction of thorium metal with graphite was studied in the temperature range of 900 to 1600°C. It was found that the reaction rate was parabolic and the activation energy for the reaction was 53 kcal/mole below 1200°C. Marker experiments showed that the growth of the carbide film was due mainly to the migration of carbon. From these results the rate determining process of the reaction seems to be the diffusion of carbon through the carbide film formed on the metal surface. Hydrocarbons, yielded by hydrolysis of the carbide film, were analyzed by the gas-chromatographic method, from which the ratio of ThC/ThC_2 in the carbide film was determined. The film formed below 1200°C was composed of ThC only. However, in the film formed above 1300°C the ratio of ThC/ThC_2 decreased with increasing temperature. These results were confirmed by the x-ray-diffraction technique. Parabolic rate constants for ThC and ThC_2 formations and apparent rate constants for the carbide film growth were obtained from the rate constant of the total carbide formation and the ThC/ThC_2 ratio in the carbide. The activation energy for the ThC_2 formation was found to be 120 kcal/mole from the results above 1300°C. The diffusion coefficient of carbon in ThC was calculated from the rate constants for the carbide formation. The amount of thorium carbide, which forms in a thorium blanket of a graphite matrix fuel reactor, was estimated. (auth)

2849 THE REACTION OF URANIUM WITH GRAPHITE AT HIGH TEMPERATURES. Sakae Takeuchi (Tohoku Univ., Sendai), Toshio Honma, and Tsuneo Satow. Trans. Japan Inst. Metals, 5: 111-15(Apr. 1964).

The reaction of uranium metal with graphite was studied in the temperature range of 800 to 1100°C. It was found that the reaction rate is parabolic and that the activation energy for the reaction is 59 kcal/mole. Marker experiments showed that the growth of the carbide film was due mainly to the migration of carbon. From these results the rate determining process of the reaction seems to be the diffusion of carbon through the carbide film formed on the metal surface. Hydrocarbon, yielded by hydrolysis of the carbide film, was analyzed by the gas-chromatographic method. From these results it was confirmed that the film formed in the temperature range was composed of UC only. These results were confirmed by the x-ray-diffraction technique. From these parabolic rate constants, the self-diffusion coefficients of carbon in UC were calculated. (auth)

2850 CONSEQUENCES OF NON-STOICHIOMETRIC BEHAVIOUR OF REFRACTORY MATERIALS AT HIGH TEMPERATURES. J. S. Anderson (National Chemical Lab., Teddington, Eng.). p.285-312 of "High Temperature Technology." Washington, D. C., Butterworths, 1964.

A semi-theoretical treatment of nonstoichiometric effects, particularly equilibrium of lattice defects, is outlined, in terms of which the experimentally observed properties of some refractory, binary compounds are considered. Several types of high-temperature reaction processes that hinge on the stoichiometric indeterminacy of solid compounds are then discussed, together with reactions with a gaseous environment. (D.C.W.)

2851 REFRACTORY PYROLYTIC MATERIALS. R. J. Diefendorf (General Electric Research Lab., Schenectady, N. Y.). p.313-24 of "High Temperature Technology." Washington, D. C., Butterworths, 1964.

Techniques for pyrolytic deposition of refractory materials are outlined; and the deposition mechanism is described, treating carbon deposition from hydrocarbons at high temperature as an example. The properties and structure of pyrolytic deposits are discussed, and difficulties in the use of pyrolytic materials are indicated. (D.C.W.)

2852 ENTHALPY AND HEAT CAPACITY OF SOME SOLID MATERIALS AT EXTREMELY HIGH TEMPERATURES. V. A. Kirillin, A. E. Sheindlin, and V. Ya. Chekhovskoi (Scientific Research Inst. of High Temperatures, Academy of Sciences, USSR). p.471-84 of "High Temperature Technology." Washington, D. C., Butterworths, 1964.

The results of experimental determinations of the enthalpy and heat capacity of corundum, molybdenum, tungsten, and silicon carbide containing free carbon are presented; and the experimental apparatus and procedure are briefly described. Temperatures to 2000–3000°K are covered. (D.C.W.)

2853 STABILITY OF HIGH NICKEL ALLOYS IN SUPERHEATED STEAM. F. A. Comprelli and U. E. Wolff (General Electric Co., San Jose, Calif.). Metals Park, Ohio, American Society for Metals, 1964, Technical Report No. P 12-4-64, 45p. $3.00. (CONF-778-1).

From Metals/Materials Congress, Philadelphia, Oct. 1964.

The room-temperature tensile properties and microstructural characteristics of superheat cladding materials were evaluated as a function of exposure at 1050 and 1150°F for periods up to 10,000 hours. The alloys of interest for superheat reactor applications are the solid solution alloys Hastelloy X, Inconel 625, Inconel 800, Ni-O-Nel 825, and Inconel 600. These alloys, when subjected to prolonged exposure at these temperatures, exhibit metallurgical changes that affect the properties of the material. The test results indicate that each alloy was subject to some degree of thermal instability after very long exposure at temperature, as evidenced by carbide precipitation, a progressive strengthening of the alloy, and a corresponding reduction in ductility. (auth)

Radiation Effects

Refer also to abstract 2405.

2854 (AD-441018) A STUDY OF THE ELECTRICAL CONDUCTIVITY OF ALUMINA AT HIGH TEMPERATURES AND IN A RADIATION FIELD (thesis). William Bernard Haidler (Arizona. Univ., Tucson). [1963]. 91p.

Techniques and equipment were developed to permit measuring the electric conductivity of a ceramic specimen at high temperature and in a radiation field. The measurements were performed between ambient and 1800°K and at zero and 6 kw/liter of reactor power. The current through a polycrystalline alpha-alumina (Lucalox) sample was measured and the data were analyzed to yield the following conclusions: (1.) The in-core electric conductivity measurements are in reasonable agreement with previous out-of-core determinations. (2.) Irradiation of the specimen at 6 kw/liter causes a large increase in electric conductivity at room temperatures; however, as the specimen temperature is increased the relative effect of the radiation field decreases until at temperatures above 767°K it is insignificant in polycrystalline alpha-alumina. (3.) The increased electric conductivity is caused by the reactor gamma emissions interacting within the specimen to cause an increased number of electronic charge carriers. (4.) There was no indication of polycrystalline alpha–alumina becoming an intrinsic semiconductor in the temperature range 300–1600°K. (5.) Electronic conduction possibly accounted for conductivity below 1000°K above which extrinsic ionic conduction took place. The activation energies of the processes were determined to be 0.47 ev and 1.9 ev respectively. The principal systematic errors imposed by the in-core test were in the determination of the specimen temperature and the current passing through the specimen. Because of these, less importance is assigned to the absolute values of electric conductivity obtained than to the relative change with irradiation. (auth)

2855 (FTDM-3053) MATERIALS—CERAMIC BONDED SOLID FILM LUBRICANTS—EFFECTS OF IRRADIATION AND HIGH TEMPERATURE ON. (General Dynamics/Fort Worth. Div. of General Dynamics Corp., Fort Worth, Tex.). Oct. 23, 1962. Contract AF33(657)-11214. 8p. (AD-438137). $0.50(OTS).

Wear life determinations were conducted on irradiated lead sulfide–molybdenum disulfide–boric oxide and molybdenum disulfide–graphite–sodium silicate solid-film lubricants. The results indicate no significant effects of reactor radiation on the wear life characteristics. (D.L.C.)

2856 (HW-79559) IRRADIATION BEHAVIOR OF HIGH-PURITY URANIUM. R. D. Leggett, B. Mastel, and T. K. Bierlein (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 1963. Contract AT(45-1)-1350. 55p. Dep.; $3.00(cy), 2(mn) OTS.

NaK-filled, controlled temperature capsules were used to establish the irradiation behavior of small, nonclad, tubular, high-purity dingot, uranium specimens over the temperature range 300 to 650°C and burnup range 0.03 to 0.4 at. %. Density measurements and optical and electron metallography were used to assess the irradiation effects. It was established that fission gases play only a minor role in the irradiation behavior of these uranium specimens. Below 600°C the interaction and recovery of fission event induced defects lead to gross specimen distortion and in the 400 to 600°C range account for very large volume increases. Above 600°C the volume increase is much smaller, and agglomeration of fission gas into pores becomes a contributing factor; below 350°C no volume change occurs. Four metallographically distinct temperature regions of irradiation damage were noted and the operative mechanisms identified. Below 350°C a severely worked microstructure develops as a result of plastic flow induced by the tendencies of individual grains to undergo irradiation growth analogous to the behavior of single crystals. The specimen accommodates this plastic flow and remains coherent so that no volume change occurs. In the 400 to 500°C range the severely worked microstructure also develops because of the growth tendencies of individual grains, but the grain boundaries are no longer capable of accommodating the plastic flow. Tears develop at grain boundary triple points and along grain boundaries resulting in very large volume increases. This loss of grain boundary coherency is associated with the recovery of the cold work induced by the plastic flow and is similar to the intermediate temperature, low ductility observed with many metals that are strained at recovery temperatures. In the 500 to 600°C range individual grains tend to retain their shape although a few deformation twins develop. Crystallographically aligned porosity accounts for the large volume changes which are observed. These aligned pores are irregular in shape and are believed to be tears. The tears develop through the recovery and interaction of lattice defects and stresses produced by the fission event; the tears contain little or no fission gas. Above 600°C the original grain structure is retained. The pores that develop at grain boundaries and the tiny pores that form throughout the matrix account for the relatively small volume increase. The grain boundary pores are thought to originate by processes similar to the formation of aligned tears in the 500 to 600°C range. They probably contain gas that has migrated to them subsequent to their formation. The tiny spherical pores throughout the matrix are fission gas pores in which the internal gas pressure is balanced by surface tension forces. (auth)

2857 (HW-SA-3129) IRRADIATION OF URANIUM–PLUTONIUM OXIDE. W. J. Bailey and T. D. Chikalla

(General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Nov. 8, 1963]. Contract [AT(45-1)-1350]. 23p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A series of UO_2-PuO_2 capsules was irradiated in the MTR to determine the irradiation performance of sintered dense pellets and to investigate the irradiation sintering of low-density pellets. Irradiation and fission gas release data are tabulated, and the fission product distributions are plotted against pellet radius. The results show that fission gas release is more affected by rod power than by PuO_2 concentration, that radial migration of ^{137}Cs and ^{106}Ru occurs during irradiation, and that the irradiation performance of UO_2-PuO_2 fuels compares favorably with that of UO_2. (D.L.C.)

2858 (LADC-6393) TECHNIQUES USED IN THE REMOTE METALLOGRAPHY OF IRRADIATED PLUTONIUM. C. C. Burwell, W. E. Ferguson, and F. H. Newbury (Los Alamos Scientific Lab., N. Mex.). [1959]. Contract W-7405-eng-36. 10p. (CONF-654-17). Dep.(mn); $1.00 (cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

A description is given of several new techniques used in the Pu metallography train in the Los Alamos Wing 9 Facility. These techniques include cloth changing on a remotized vibratory polisher, chemical etching, alpha-sealed metallograph viewing, recovery of Pu from mounting plastics, and a sample-holding fixture for preparation of small odd-shaped specimens using an abrasive cut-off wheel. (D.L.C.)

2859 (NRL-6160) NEW INFORMATION ON NEUTRON EMBRITTLEMENT AND EMBRITTLEMENT RELIEF OF REACTOR PRESSURE VESSEL STEELS. L. E. Steele and J. R. Hawthorne (Naval Research Lab., Washington, D. C.). Aug. 7, 1964. Contract AT(49-5)-2110. 34p. (CONF-512-10) Dep.(mn); $2.00(cy), 1(mn) OTS.

From American Society for Testing and Materials 67th Annual Meeting, Chicago, June 1964.

Significant embrittlement of several reactor pressure vessel steels as a result of exposure to neutrons has been demonstrated. Neutron embrittlement of the carbon and low-alloy steels investigated has been defined in terms of increase in the nil ductility transition (NDT) temperature. Increases in the NDT of pressure vessel steels as great as 545°F have been observed. The extent of embrittlement has been shown to depend upon the neutron exposure (n/cm^2 > 1 Mev), the type of steel, and the irradiation temperature. Embrittlement relief through annealing heat treatment at temperatures above the pressure vessel operating temperature has been demonstrated. Significant embrittlement relief was observed even with multiple irradiation-annealing cycles, the extent of relief being primarily dependent upon the irradiation temperature and the subsequent annealing temperature. Experimental data are reviewed with consideration for application to operating nuclear pressure vessel conditions. Preliminary results of power reactor surveillance and of the evaluation of one pressure vessel after nuclear service are related to experimental results. The value of extending the evaluation of surveillance specimens and of pressure vessels after removal from nuclear service are reviewed with reference to current uncertainties as to possible nuclear environmental and stress effects. Possibilities for using the favorable aspects of certain variable experimental factors, such as difference in embrittlement sensitivity between steels, are suggested for minimizing steel embrittlement in future reactors. (auth)

2860 (ORNL-P-631) PROPERTIES OF BeO COMPACTS IRRADIATED AT FAST-NEUTRON DOSES GREATER THAN 10^{21} NEUTRONS/cm^2. G. W. Keilholtz, J. E. Lee, Jr., and R. E. Moore (Oak Ridge National Lab., Tenn.). [1964]. Contract W-7405-eng-26. 28p. (CONF-792-1). Dep.(mn); $2.00(cy), 1(mn) OTS.

From American Ceramic Society Meeting, San Francisco, Oct. 1964.

Experiments were conducted to compare the radiation damage to BeO compacts of different grain sizes and densities as a function of flux, dose, and temperature (110, 650, and 1100°C). Volume expansion was measured. and micrographic and x-ray diffraction examinations were made; some single-crystal studies were also made. At 110°C, most specimens disintegrated at doses >2×10^{21} neutrons/cm^2, and no grain-size effect appeared. At 650 and 1100°C, BeO compacts of low density and small grain size withstood irradiation better than other types, while BeO of high density and large grain size was damaged to the greatest extent. No flux intensity effect was found. The radiation damage mechanism is discussed. (D.L.C.)

2861 IRRADIATION EFFECTS IN URANIUM MONONITRIDE. R. A. Wullaert (Battelle Memorial Inst., Columbus, Ohio), J. E. Gates, and J. Bugl. Am. Ceram. Soc. Bull., 43: 836-41(Nov. 1964).

The effects of fissioning up to 3.8 at. % of uranium in specimens of 96 to 99% dense UN at fuel centerline temperatures up to 1260°C are discussed. No marked dimensional instability was observed in the UN irradiated at initial surface and centerline temperatures as high as 615 and 1260°C, respectively, and to total uranium burnups as high as 3.8 at. %. The amount of fission gas released by UN was only 0.3 to 0.6% of that produced in the fuel. Hydrogen produced by the $^{14}N(n,p)$ reaction did not appear detrimental to the radiostability of UN. UN was compatible with Type 304 stainless steel at fuel surface temperatures up to 615°C. It was concluded that within the limits of the experiment UN exhibits good dimensional and microstructural stability when subjected to thermal neutron irradiation. (P.C.H.)

2862 GAMMA RADIATION EFFECTS ON THE ELASTIC PROPERTIES OF CHALCOGENIDE GLASS OF $As_2Se_3-As_2Te_3$ SYSTEM. I. A. Domoryad and D. Kaipnazarov (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 3, 67-70 (1964). (In Russian)

A torsion oscillation method was used in an investigation of γ effects on the elastic properties of $As_2Se_3-As_2Te_3$ chalcogenide glass. The glass was irradiated at 35°C using a ^{60}Co source at dose rates from 100 to 500 R/sec to doses of 5×10^3 R. The shift modulus and the effects of integral dose were calculated (R.V.J.)

2863 THE CHANGE OF PEARL COLORS BY THE IRRADIATION WITH γ-RAY OR NEUTRON RAY. Tadashi Tsujii (Prefectural Univ. of Mie, Japan). J. Radiation Res. (Japan), 4: 120-5(June, Sept., Dec. 1963).

Both the pearl layer in shell or in pearl of fresh-water clam easily change its color from original to black by irradiation. In order to clarify the mechanism of the coloration, the colored pearls were observed using chemical and physical methods. In physical observation, in the colored pearls examined submicroscopically using the electron microscope and x-ray diffractometer and heat effects, no physical differences can be found before and after irradiation. In chemical observation, the shell of fresh-water clams contain comparatively larger amounts of Mn than those of marine ones. Results suggest that the greater part of Mn in the shell of fresh-water clam really exists and its oxides caused by the irradiation are possibly due to the blackish color. (auth)

2864 ELASTIC VERSUS INELASTIC ENERGY LOSS OF RECOIL GERMANIUM AND SILICON ATOMS. E. G. Wikner, H. Horiye, and D. K. Nichols (General Dynamics Corp., General Atomic Div., San Diego, Calif.). Phys. Rev., 136: A1428-32(Nov. 30, 1964).

Experiments establish the photoneutron method of producing displacement radiation effects by measuring the effect of recoils from $Si(\gamma,n)$ reactions on the excess carrier lifetime. These experiments have been extended to Ge together with an additional experiment in which Si and Ge were bombarded by a 1-Mev reactor neutron spectrum and a monoenergetic beam of 14-Mev neutrons. The range of average energies of the recoil atoms from the bremsstrahlung experiment spans the range of the recoil atom energies of the neutron experiment, so that the results can be compared with theoretical calculations that assume vary-

ing percentages of elastic and inelastic energy loss of the recoils. The results agree with theory based on a broad transition-energy region between elastic and inelastic energy losses. (auth)

2865 PRTR FUEL ELEMENT EXPERIENCE. M. D. Freshley (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 388-9(Nov. 1964).

2866 FISSION PRODUCT DISTRIBUTION IN IRRADIATED UO_2. J. L. Bates (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 389-90(Nov. 1964).

2867 MELTING POINT OF IRRADIATED URANIUM DIOXIDE. J. A. Christensen, R. J. Allio, and A. Biancheria (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 390-1(Nov. 1964).

2868 EXPANSION OF HYPER- AND SUBSTOICHIOMETRIC U, Pu OXIDE FUEL AT IRRADIATIONS TO 70 000 Mwd/t. E. L. Zebroski, W. E. Baily, and D. P. Hines (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 7: 394-5(Nov. 1964).

2869 IRRADIATION OF (THORIUM, PLUTONIUM) O_2. M. D. Freshley and H. M. Mattys (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 402-3(Nov. 1964).

2870 FATIGUE AND BURST TESTS ON IRRADIATED IN-PILE STAINLESS STEEL PRESSURE TUBES. L. A. Waldman and M. Doumas (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 419-20(Nov. 1964).

2871 RADIATION EFFECTS ON THE MECHANICAL PROPERTIES AND MICROSTRUCTURE OF TYPE-304 STAINLESS STEEL. J. S. Armijo (General Electric Co., Pleasanton, Calif.), U. E. Wolff, and J. R. Low, Jr. Trans. Am. Nucl. Soc., 7: 421-2(Nov. 1964).

2872 INFLUENCE OF PREIRRADIATION HEAT TREATMENT ON THE POSTIRRADIATION DUCTILITY OF STAINLESS STEELS. W. R. Martin and J. R. Weir (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 422-3(Nov. 1964). (ORNL-P-170)

2873 ELECTRICAL CONDUCTIVITY OF ALUMINA IN RADIATION FIELDS. Monte V. Davis, Gary J. Dau, and William B. Haidler (Univ. of Arizona, Tucson). Trans. Am. Nucl. Soc., 7: 440(Nov. 1964).

2874 URANIUM–10 MOLYBDENUM FUEL ELEMENT IRRADIATION IN SRE. J. L. Arnold, S. O. Arneson, and K. J. Miller (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 447(Nov. 1964).

2875 TRANSIENT IN-PILE OXIDATION EXPERIMENTS ON METALLIC FUELS. Harry Lawroski (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 447-8(Nov. 1964).

2876 STUDIES ON THE MELTDOWN IN WATER OF OXIDE CORE, ZIRCALOY-2 CLAD FUEL IN TREAT. R. C. Liimatainen (Argonne National Lab., Ill.), L. Baker, Jr., R. O. Ivins, F. J. Testa, J. F. Boland, and H. Lawroski. Trans. Am. Nucl. Soc., 7: 448-9(Nov. 1963).

2877 EFFECTS OF EXTREME OPERATING CONDITIONS ON PROTOTYPE EGCR FUEL. M. F. Osborne, J. G. Morgan, and E. L. Long, Jr. (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 449(Nov. 1964).

2878 10,000 MWd/TONNE FROM UO_2 CLAD IN THIN ZIRCALOY. R. D. MacDonald and A. S. Bain (Atomic Energy of Canada Ltd., Chalk River, Ont.). Trans. Am. Nucl. Soc., 7: 449-50(Nov. 1964).

2879 RECENT HIGH TEMPERATURE IRRADIATION EXPERIMENTS ON COATED PARTICLE FUEL FOR THE DRAGON REACTOR. R. A. U. Huddle (United Kingdom Atomic Energy Authority, Winfrith, Dorset, Eng.), P. Barr, G. Hauser, C. Vivante, and J. H. Coobs. Trans. Am. Nucl. Soc., 7: 450-1(Nov. 1964).

2880 TENSILE PROPERTIES OF FUEL CLAD MATERIALS IRRADIATED IN SUPERHEAT ENVIRONMENTS. F. A. Comprelli, B. C. Beaudreau, H. J. Busboom, and C. N. Spalaris (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 7: 455-6(Nov. 1964).

2881 FUEL-ELEMENT IRRADIATIONS IN SUPERHEATED STEAM. C. N. Spalaris, R. F. Boyle, H. J. Busboom, and V. E. Hazel (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 7: 456-7(Nov. 1964).

2882 PERFORMANCE OF PRE-OXIDIZED ZIRCALOY CLAD FUEL RODS IN THE SAXTON REACTOR. D. R. McClintock (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 457-8(Nov. 1964).

2883 HOT-CELL TECHNIQUES FOR THE EVALUATION OF FUELED GRAPHITE SPHERES. D. R. Cuneo, E. L. Long, Jr., and H. E. Robertson (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 477-8(Nov. 1964).

2884 ANODIC OXIDE FILMS ON ALUMINUM AS SOURCES OF RADIOACTIVITY. A. F. Bogoyavlenskii. p.242-50 of "Mezhvuzovskaya Konferentsiya po Anodnoy Zashchite Metallov ot Korrozii. 1st, Kazan, 1961." Moscow, Izd-vo Mashinostroenie, 1964.

Applicator films prepared with ^{32}P, ^{35}S, ^{198}Au, ^{185}W, and other isotopes were studied as possible growth depressants for seven species of fungi and yeast cells. Tentative results indicate the feasibility of using such radioactive films in contolling biological corrosion. Subsequently, ^{65}Zn, as zinc nitrate, was used in the carbonate oxidation (5% solution of sodium carbonate plus 0.5% caustic soda) of clad sheet duralumin DT16 (20–30°C, 0.5 a/dm^2, 20 min) to obtain radioactive applicator films for use in systems for signalling corrosion of heating elements caused by seepage of pickling and plating bath solutions. The system illustrated is sensitive to decreases in radiation intensity of up to 400 counts/min from initial levels of 600 to 15000 counts/min. Finally, reference is made to the advantages of radioactive Al_2O_3 films for radiotherapeutic applications. (OTS)

METEOROLOGY

2885 NEW APPROACHES TO AIR POLLUTION STUDIES. I. J. Wright (Tracerlab, Inc., Richmond, Calif.). p.119-24 of "Nuclear Applications to the Wood, Paper, and Pulp Industries Conference." Pullman, Wash., Washington State Univ., 1964.

Results are summarized of a study of industrial fallout in Ventura County, California, which was conducted using a stable-tracer activation-analysis technique. In this study, Sm–Ho and Ag stable tracers were used to determine the contribution to the dust fall from a specific aggregate-processing plant. A proposed study of the ventilation in the San Francisco Bay area is described, and some of the variables which need to be considered in this study are outlined. (D.L.C.)

2886 CONSISTENCY IN MEASUREMENTS OF DIFFUSION. J. Saiessac. 7p. (CONF-337-21). (In French)

From International Conference on Radioactive Pollution of Gaseous Media Saclay, France, Nov. 1963.

An approximation of stationarity in the atmosphere is given and experimental results on the heat flux were examined as a function of the vertical thermal gradient and at stationarity values ≤0.2. The coefficients of turbulent viscosity are given as a function of the vertical temperature gradient. The cases where stationarity is approached in nature are defined. (J.S.R.)

PHYSICS

General

2887 (BSD-TDR-64-20) EXPERIMENTAL STUDIES OF STRONG HALL EFFECTS AND VXB-INDUCED IONIZATION. Research Report No. 177. J. Klepeis and R. J. Rosa (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Sept. 1964. Contracts AF04(694)-33 and AF04 (694)-414. 31p. (AD-606889). $2.00(OTS).

Studies performed using a graphite inert gas heater are described, typical flow conditions being 100 g/sec argon at one atmosphere pressure and 1800 to 2000°K seeded with 0.1 to 1% cesium vapor. The aim of this work was primarily to study MHD channel and electrode performance at high values of $\omega\tau$ (5 to 15) and secondarily, to look for the occurrence of extra-thermal ionization. Many different channel and electrode configurations were tested. Straight-segmented electrode channels did not perform well, apparently due to nonuniformity created by extra-thermal ionization over the electrode walls. Channel geometries in which the normal current closes upon itself performed much better and substantial enhancement of the power output due to $V \times B$ induced ionization was observed. The results agree with results obtained in applied electric fields and with theory when energy loss due to radiation is included. (auth)

2888 (LA-DC-6464) PROPERTIES OF THE bcc-hcp PHASE TRANSITIONS OF He^3 AND He^4. A. F. Schuch and W. C. Overton, Jr. (Los Alamos Scientific Lab., N. Mex.). [1964]. Contract W-7405-eng-36. 11p. (CONF-651-12). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 9th International Conference on Low Temperature Physics, Columbus, Ohio, Aug.-Sept. 1964.

The correlation $M\Theta R^2$ = constant for both ^3He and ^4He on both sides of the hcp-bcc phase transition curve is discussed. (M = atom mass, Θ = Debye temperature, and R = nearest-neighbor separation.) Since the correlation $M\Theta R^4$ = constant is almost equally good, an empirical analysis is made of both correlations. Zero-point energies are calculated for both correlations, and the results show that the $M\Theta R^4$ correlation is more acceptable. However, the $M\Theta R^2$ correlation may provide some insight into the nature of the transitions. (D.L.C.)

2889 (ORNL-3705) MÖSSBAUER STUDIES OF THE HYPERFINE STRUCTURE SPECTRA OF ^{57}Fe IN FeRh ALLOYS, α-Fe_2O_3 AND $FeNH_4(SO_4)_2 \cdot 12H_2O$ (thesis). D. W. Forester (Oak Ridge National Lab., Tenn.). Nov. 1964. Contract W-7405-eng-26. 104p. Dep.; $4.00(cy), 2(mn) OTS.

Submitted to Univ. of Tennessee.

An investigation was conducted to study the magnetic properties of several Fe compounds and alloys, using the effective field model, and to study the validity of the effective field model by means of experiments on a dilute paramagnetic salt. For the Fe–Rh alloys (50 to 53.5% Rh) and α-Fe_2O_3, the effective field model gave a good description of the observed magnetic hfs splittings. The temperature dependence of the effective magnetic field was also determined. The Fe–Rh measurements indicate that the γ phase may undergo a transition to a magnetic phase at ~80°K and at higher temperatures. For ferric-ammonium-alum, the effective field model did not give a good description of the magnetic hfs spectra, presumably due to fluctuation effects in the electron and nuclear spin system. (D.L.C.)

2890 (ORNL-TM-991) PROGRAMS TO CALCULATE THE LATTICE VIBRATION FREQUENCY SPECTRUM OF GRAPHITE BY THE ROOT-SAMPLING METHOD. J. V. Wilson (Oak Ridge National Lab., Tenn.). Oct. 28, 1964. Contract W-7405-eng-26. 21p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Two short FORTRAN programs for calculating the lattice vibration frequency spectrum of graphite are presented. These calculate the spectrum for modes in the plane of the hexagon lattice and for modes normal to that plane, using the root-sampling method and the theory of Yoshimori and Kitano. (auth)

2891 (PAN-518/II) A DIFFERENTIAL METHOD FOR HALL COEFFICIENT MEASUREMENTS IN AC MAGNETIC FIELD. H. Rzewuski and Z. Werner (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Apr. 1964. 16p. Dep.

A compensation method for Hall coefficient measurements with an audio frequency magnetic field and d-c sample current is described. An a-c magnetic field is generated in a ferrite cored coil working in a series resonance circuit. Compensation is achieved in a wide frequency range of the magnetic field by the use of RC bridges and a differential amplifier. The method eliminates spurious emf's and permits the fast (pulsed) changes of Hall coefficient to be measured with high sensitivity. The results obtained are as follows: frequency range: f = (1 ÷ 20) kcps; noise level: $U_n \simeq 0.2\ \mu V$ for $\Delta f = 25$ cps; sensitivity: $U_s = 10^{-4}\ U_m + U_n$, U_m = the measured voltage; and stability: $s = 10^{-4}/h$. There exists a possibility of further increase of the sensitivity and frequency range of the method. (auth)

2892 (TID-21310) THE REFRACTIVE INDEX OF FC-75. Technical Report No. 419. D. L. Wilson (Maryland. Univ., College Park). Oct. 1964. Contract AT (40-1)-2504. 19p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The index of refraction of FC-75 in the visible and ultraviolet regions was measured using a hollow prism, and the variation of index with temperature was determined. A summary of available data on the refractive index for other liquids and solids useful as Čerenkov radiators was also made. (auth)

2893 (JPRS-27049(p.79-83)) MÖSSBAUER EFFECT OF Fe^{57} 14.4-Kev γ RAY. Ying-ting Hsu, Chi-mou Ma, Yu-fu Wang, and Pao-chen Hsieh. Translated from K'o Hsueh T'ung Pao, No. 7, 617-19(July 17, 1964).

The principle of the Mössbauer effect is discussed briefly. Some preliminary results are reported of studies of the application of the Mössbauer effect of the ^{57}Fe 14.4-kev γ ray. Graphs are given of the scintillation spectrum of ^{57}Co, recoilless resonant absorption by ^{57}Fe, and resonant absorption speed spectrum. (D.L.C.)

2894 ADIABATIC INVARIANCE·V: MULTIPLE PERIODS. J. E. Littlewood (Trinity Coll., Cambridge, Eng.). Ann. Phys. (N. Y.), 30: 138-53(Oct. 20, 1964).

A system of $\underline{n}$ linear differential equations $\ddot{x}_\lambda + \Sigma_\mu A_{\lambda\mu} x_\mu + \Sigma_\mu B_{\lambda\mu} \dot{x}_\mu = 0$ ($\lambda,\mu = 1,2, \ldots, n$), where $A_{\lambda\mu}$, $B_{\lambda\mu}$ are slowly varying functions of t in $-\infty < t < \infty$ are considered. Suppose that if the coefficients are frozen at their values for any value τ of t the modified equations have distinct real periods $2\pi/\omega_\lambda(\tau)$. The question of whether, subject to appropriate conditions about the slow variation, in terms of a small ϵ, and in analogy with the results for the equation $\ddot{x} + \omega^2 x = 0$ (Lorentz's pendulum problem), invariants $J_\lambda(t)$ will exist, of the usual $\int p\, dq$ form, in the sense that $J_\lambda(t) = J_\lambda(0) + O(\epsilon)$ for all t is investigated. The answer is no. But it is found that functions $F_\lambda(t)$ exist, depending only on the coefficients, such that $J_\lambda^*(t) = F_\lambda(t) J_\lambda(t) = J_\lambda^*(0) + O(\epsilon)$ for all t. The work is performed with n = 3, which is effectively general. There are further developments if one or more of the $J_\lambda(0)$ are $O(\epsilon^2)$. In this case the $J_\lambda(t)$ concerned are $O(\epsilon^2)$ for all t. (auth)

2895 THE METHOD OF ELEMENTARY SOLUTIONS FOR TIME-DEPENDENT PROBLEMS IN LINEARIZED KINETIC THEORY. Carlo Cercignani and Franco Sernagiotto (Appliazionie Ricerche Scientifiche, Milan). Ann. Phys. (N. Y.), 30: 154-67(Oct. 20, 1964).

The method of elementary solutions, previously introduced for steady problems, is extended to treating problems depending on time as well as on space in linearized

kinetic theory of gases, when the Bhatnagar, Gross, and Krook model is used. Shear flow problems are investigated, and the general features of the Laplace transform of the solution are shown. Besides, a solution of Rayleigh's problem in terms of quadratures is given, which appears to be the first known solution valid for arbitrary Knudsen number. It is worthwhile to note that the solution is the exact solution for the adopted model. (auth)

2896 CONTRIBUTION TO DETERMINABILITY OF APPLICABILITY OF A PRINCIPLE OF EXTREME ENERGY DEMAND IN CURRENT TRANSFER THROUGH A CONDUCTOR. Kurt H. Kischel and Johannes Wilhelm (Universität, Greifswald, Ger. and Institut für Gasentladungsphysik, Deutsche Akademie der Wissenschaften, Greifswald, Ger.). Beitr. Plasmaphysik, 1: 11-29(1960-61). (In German)

It is shown that the principle of extreme energy demand in use functions as an independent additional assertion and in that sense provides connections between the conductivities. The studies were made to prove or disprove the minimum principles of the Steenbeck type. The minimum principles in the channel model, the Steenbeck principle as a variation problem, evaluations of results of theory and experiment, the Warner model of electric heat transfer, and formulation of the Steenbeck extreme principle are discussed. (M.C.G.)

2897 FIFTY-THIRD MAY LECTURE: THE HOW AND WHY OF STRONG MAGNETIC FIELDS. N. Kurti (Oxford Univ.). J. Inst. Metals, 93: 1-10(Sept. 1964).

Classical means of producing magnetic fields, magnetic fields from solenoids, use of superconductors, and some uses of high magnetic fields are discussed. (P.C.H.)

2898 HYDROMAGNETIC LAMINAR BOUNDARY LAYER FLOW PAST A NON-CONDUCTING INFINITE POROUS FLAT PLATE WITH TIME-DEPENDENT FREE STREAM VELOCITY. Dilip Singh and Girish Chandra Pande (Lucknow Univ., India). J. Phys. Soc. Japan, 19: 1704-8(Sept. 1964).

Unsteady, laminar, boundary-layer flow of a viscous, incompressible, electrically conducting fluid past a non-conducting, infinite, porous flat plate subjected to a constant suction in the presence of a uniform, transverse magnetic field is studied. The free stream velocity is assumed to be time-dependent. General formulas for the velocity, induced magnetic field, current density and displacement thickness are obtained as a function of free stream velocity by using the method of Laplace transformation under the conditions: the magnetic Prandtl number is unity and the Alfvén wave velocity is less than the suction velocity. The case of impulsive free stream velocity is considered in detail. (auth)

2899 INITIATION OF ELECTRICAL BREAKDOWN IN ULTRAHIGH VACUUM. D. Alpert, D. A. Lee, E. M. Lyman, and H. E. Tomaschke (Univ. of Illinois, Urbana). J. Vacuum Sci. Technol., 1: 35-50(Nov.-Dec. 1964).

Existing theories for the initiation of electrical breakdown are reviewed, together with the experimental observations on which they are based. Experiments described have extended the available data on electrical breakdown between broad area electrodes under ultrahigh-vacuum conditions. The results, together with those of several other experimenters, are interpreted on the basis of a single picture that explains and relates the phenomena of predischarge currents and the initiation of breakdown. Based on field emission from sharp submicroscopic points, this picture predicts breakdown when the local electric field at the cathode reaches a critical value. The local field, which for broad area electrodes may be much larger than the average field, is deduced from observations of field emission prior to breakdown. When properly analyzed, data for tungsten electrodes from this research and several others indicate a value for the electrical field at breakdown independent of gap spacing or geometrical configuration for voltages up to 250 kv. The critical breakdown field for tungsten is 6.5×10^7 v/cm. Other phenomena associated with electrical breakdown are also considered. (auth)

2900 MECHANICAL GAS DOSING CONTROL VALVE FOR ION SOURCES. Andrzej Lipinski and Henryk Malecki (Uniwersytet Lodzki, Lodz, Poland). Nukleonika, 9: 499-500(1964). (In Polish)

2901 CORRELATION-FUNCTION METHOD FOR THE TRANSPORT COEFFICIENTS OF DENSE GASES. I. FIRST DENSITY CORRECTION TO THE SHEAR VISCOSITY. Kyozi Kawasaki and Irwin Oppenheim (Massachusetts Inst. of Tech., Cambridge). Phys. Rev., 136: A1519-34(Dec. 14, 1964).

The first density correction to the shear viscosity of the classical gas is calculated using the autocorrelation function expression. The technique employed is that due to Zwanzig suitably generalized to include dynamical fluxes containing particle coordinates. If only repulsive forces are considered, the result is in complete agreement with that of Choh and Uhlenbeck obtained with the use of Bogolyubov's theory. (auth)

2902 ONE-DIMENSIONAL ELECTRON-PHONON MODEL. Stanley Engelsberg and B. B. Varga (Princeton Univ., N. J.). Phys. Rev., 136: A1582-98(Dec. 14, 1964).

The properties of a one-dimensional system of degenerate electrons coupled to long-wavelength phonons are investigated. The equivalent model hamiltonian of Tomonaga, which describes the electrons by density waves, is diagonalized to normal modes. These are calculated for the Einstein model and constant coupling, and used to get the ground-state energy. A physical interpretation of the model is given. The breakdown of the system for strong coupling is discussed. The many-body perturbation theory is used to assess the validity of the Tomonaga model. The electron-phonon ground-state energy diagrams may be grouped in two sets as Tomonaga and non-Tomonaga. The latter cancel among themselves exactly to a high order. The extent of the cancellation in three dimensions is treated in fourth order and found to be significant, but not exact. (auth)

2903 STATISTICAL THEORY OF MAGNETIC SUSCEPTIBILITY OF AN IMPERFECT GAS. Allan N. Kaufman (Univ. of California, Livermore) and Toshio Soda. Phys. Rev., 136: A1614-25(Dec. 14, 1964). (UCRL-7776)

The linear response of an imperfect gas in thermal equilibrium to a nonuniform external magnetostatic field is studied, using a linked-diagram evaluation of the grand partition function. Account is taken of the molecular structure, of short-range molecular interaction and correlation, and of the long-range dipole-dipole interaction. In addition, a multipole expansion of the molecular interaction leads to the consideration of interaction terms, not heretofore studied, of order lower than or the same as that of the well-known dipole-dipole terms. The contributions of these terms are eliminated by a summation of graphs, which is an operational generalization of the conventional gauge transformation. The final result is a virial expansion of the Clausius-Mossotti function. (auth)

2904 POLARIZATION EFFECTS ACCOMPANYING POSITRON ANNIHILATION IN METALS. A. J. Zuchelli (George Washington Univ., Washington, D. C.) and T. G. Hickman. Phys. Rev., 136: A1728-30(Dec. 14, 1964).

The experimental data available concerning positron annihilation in metals are shown to be consistent with a positron-electron interaction which is the instantaneous limit of the Hubbard effective potential neglecting exchange. This is shown to reduce to a screened Coulomb potential with an exponential cutoff almost twice as large as the usual plasma cutoff. The data also suggest that the effect of electron-electron interactions upon the momentum distribution is smaller than previous calculations indicate. (auth)

2905 INFRARED LATTICE ABSORPTION OF IONIC CRYSTALS CONTAINING FINITE IMPURITY CONCENTRATIONS. J. R. Hardy (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. Rev., 136: A1745-50 (Dec. 14, 1964).

A theoretical calculation of the effect of isotopic defects on the infrared lattice absorption of ionic crystals is pre-

sented. The main concern was to establish the relative strength of the absorption by local vibrations in such a system as compared with that of the nonlocal modes. It was found that, when a local mode exists, it may display a vastly enhanced absorption cross section as compared with that of a charged defect in a nonpolar host. This effect arises from the fact that the uniform external field interacts directly with the zero-wave-vector components of the normal modes of the imperfect crystal. This interaction induces transitions into states which are not true eigenstates of the lattice hamiltonian, and in which there is an effective coupling between band and local modes that results in the scattering and absorption of band-mode phonons by the local vibrations. It was shown that if the local-mode absorption frequency is close to that of the pure crystal, a small concentration of impurity is sufficient to shift the main absorption to the local-mode frequency, as was observed in the case of Li(H,D) mixtures containing 5% D^- impurity. Furthermore, application of the theory to calculating the temperature dependence of the total vibrational absorption by the local modes of U centers (H^- or D^- ions substituted into an alkali halide) as shown that, even for single defects which produce highly localized vibrations, it is incorrect to regard the local-mode and host-lattice absorptions as independent. (auth)

2906 MECHANICAL GENERATION OF CHERENKOV EMISSION IN CONTACTING ELASTIC CONDUCTOR AND FLUID IN ISOTROPIC MAGNETIC FIELD. S. Kaliskii. Prikl. Mat. i Mekhan., 28: 862-7(Sept.-Oct. 1964). (In Russian)

A problem of Cherenkov emission in an ideally conductive fluid and in a perfectly elastic conductor in a magnetic field was studied by means of a moving mechanical impulse in motion at the contact plane between two media. Studies were made for a primary anisotropic magnetic field, and a solution was found for the problem without considering dispersion. The initial equations and boundary conditions are given. The super-magnetosonic velocity in both media, inter-magnetosonic velocity in the elastic conductor, and super-magnetosonic velocity in fluid were studied. (R.V.J.)

2907 TRANSACTIONS OF THE AMERICAN NUCLEAR SOCIETY 1964 ANNUAL MEETING, SAN FRANCISCO, NOVEMBER 30-DECEMBER 3, 1964. Malcolm D. Ferrier, ed. Trans. Am. Nucl. Soc., 7: 211-535(Nov. 1964). (CONF-654)

Summaries of the papers presented at the meeting are included. (C.E.S.)

For titles of individual papers see: 2189, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2342, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2456, 2457, 2458, 2459, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2520, 2521, 2522, 2523, 2524, 2525, 2543, 2562, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2672, 2673, 2674, 2681, 2682, 2691, 2703, 2704, 2737, 2738, 2739, 2740, 2751, 2752, 2753, 2754, 2755, 2756, 2757, 2758, 2759, 2776, 2777, 2778, 2779, 2780, 2781, 2782, 2783, 2784, 2785, 2786, 2787, 2788, 2789, 2832, 2833, 2834, 2835, 2836, 2837, 2838, 2839, 2840, 2841, 2842, 2843, 2844, 2845, 2846, 2847, 2865, 2866, 2867, 2868, 2869, 2870, 2871, 2872, 2873, 2874, 2875, 2876, 2877, 2878, 2879, 2880, 2881, 2882, 2883, 2933, 3014, 3019, 3201, 3202, 3203, 3204, 3205, 3206, 3207, 3208, 3209, 3210, 3211, 3212, 3213, 3214, 3215, 3216, 3217, 3218, 3219, 3220, 3221, 3222, 3223, 3224, 3225, 3226, 3373, 3374, 3375, 3376, 3377, 3378, 3379, 3380, 3381, 3382, 3383, 3384, 3385, 3386, 3387, 3388, 3389, 3390, 3430, 3459, 3460, 3461, 3462, 3463, 3464, 3465, 3466, 3467, 3468, 3469, 3470, 3471, 3472, 3473, 3474, 3481, 3482, 3483, 3484, 3485, 3491, 3492, 3526, 3527, 3528, 3529, 3530, 3531, 3532, 3533, 3534, 3535, 3536, 3537, 3538, 3539, 3540, 3541, 3542, 3543, 3544, 3545, 3546, 3547, 3548, 3549, 3550, 3551, 3552, 3553, 3554, 3555, 3556, 3557, 3558, 3559, 3560, 3561, 3562, 3563, 3564, 3565, 3566, 3567, 3568, 3569, 3570, 3571, 3572, 3573, 3574, 3575, 3576, 3577, 3578, 3579, 3580, 3581, 3592, 3593, 3594, 3595, 3596, 3597, 3598, 3599, 3667, 3668, 3669, 3670, 3671, 3672, 3673, 3674, 3675, 3676, 3677, 3678, 3679, 3680, 3681, 3682, 3683, 3684, 3685, 3686, 3687, 3688, 3689, 3690, 3691, 3692, 3693, 3694, 3695, 3696, 3697, 3698, 3699, 3700, 3701, 3702, 3703, 3704, 3711, 3735, 3736, 3737, 3738, 3739, 3740, 3741, 3742, 3743, 3782, 3783, 3784, 3785, 3786, 3787, 3788, 3789, 3790, 3791, 3792, 3793, 3794, 3795, and 3802.

2908 TRANSFORMATION OF FRÖHLICH HAMILTON OPERATORS. Albert Haug (Technische Hochschule, Munich). Z. Naturforsch., 19a: 1226-7(Oct. 1964). (In German)

In the theory of superconductivity, proceeding from a Hamilton operator formulated by Fröhlich, a portion of the electrons, phonons, and electron-phonon interaction were combined. This Hamilton operator was transformed in such a way that the electron-phonon interaction is separated out in the first approximation. This transformation leads to terms of the second order in the coupling constant. (M.C.G.)

2909 EXCITATION OF OPEN RESONATORS. L. A. Vainshtein (Inst. of Problems in Physics, Moscow). Zh. Tekhn. Fiz., 34: 1541-55(Sept. 1964). (In Russian)

The problem of open resonator excitation by a given source and the Koch problem were resolved by means of continuous eigenvalue functions. Conditions were found for the separation of the resonance part containing eigenvalue functions for free oscillations with small radiative damping, and explicit functions were obtained for the resonance part. It was assumed that an open resonator is produced by ideally reflecting arbitrary shape functions distributed in a homogeneous space and that the field is characterized by a scalar function obeying the wave equation. (tr-auth)

2910 EQUILIBRIUM DISTURBANCE IN CONDUCTING FLUID IN A SPHERICAL REGION IN A MAGNETIC FIELD. Yu. K. Bratukhin and M. I. Shliomis. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 4, 23-8(July-Aug. 1964). (In Russian)

Formulas were developed for a conducting viscous fluid in an arbitrarily shaped space in a homogeneous magnetic field. (R.V.J.)

2911 INTERACTIONS OF SHOCK WAVES IN IDEALLY CONDUCTING GAS WITH A WEAK MAGNETIC FIELD. V. P. Korobeinikov. Ah. Prikl. Mekhan. i Tekhn. Fiz., No. 4, 113-14(July-Aug. 1964). (In Russian)

A mathematical analysis was made of weak magnetic field perturbations produced by strong shock waves propagating from an explosion point in an infinitely conducting ideal gas with the initial density ρ_0. (R.V.J.)

2912 MAGNETOHYDRODYNAMIC THEORY OF INHOMOGENEOUS IONIZED GAS STABILITY IN A MAGNETIC

FIELD. A. M. Fridman. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 4, 115-18(July-Aug. 1964). (In Russian)

An analysis was made of the stability of small oscillations in a two component gas in a magnetic field, and it is shown that electron inertia can play a role similar to electric resistance. The possibility of such an analogy has been forwarded by H. P. Furth et. al (Phys. Fluids v. 6: No. 4, 1963). (R.V.J.)

2913 STATIONARY FLOW OF ANISOTROPIC CONDUCTING FLUID BETWEEN PARALLEL POROUS WALLS. I. P. Semenova. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 4, 118-21(July-Aug. 1964). (In Russian)

A solution was found for conducting fluid flow, taking into account simultaneously the anisotropic conductivity and transverse flow induced by the incline of one plane. (R.V.J.)

2914 DETERMINATION OF JOULE'S DISSIPATION IN A CHANNEL WITH DIELECTRIC WALLS AND ONE NON-CONDUCTING PARTITION DURING CONDUCTING FLUID FLOW IN A CHANNEL WITH INHOMOGENEOUS MAGNETIC FIELD. A. B. Vatazhin. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 4, 122-3(July-Aug. 1964). (In Russian)

Joule dissipation in a channel with one nonconducting infinitely long partition was determined assuming a medium with constant electric conductivity and flow rate and a Reynold's number much less than unity. It was found that dissipation without the partition was 1.76 times greater. (R.V.J.)

2915 CONCISE DICTIONARY OF ATOMICS. Alfred del Vecchio, ed. New York, Philosophical Library, 1964. 268p. $6.00.

Terms appearing in atomic and nuclear physics and in related fields are defined. Individuals, installations, and organizations of importance in these fields are also briefly treated. (D.C.W.)

2916 ATOMS, RADIATION AND NUCLEI. 1964 Edition of An Outline of Atomic Physics. Thomas H. Osgood, Arthur E. Ruark, and Elmer Hutchisson. Science Editions. New York, John Wiley & Sons, Inc., 1964. $2.25.

An introduction to atomic, molecular, nuclear, and elementary-particle physics is presented, with emphasis on principles. Cosmic radiation, applications of nuclear physics, and relativity theory are also considered. (D.C.W.)

2917 PRÉCIS D'ELECTROMAGNETISME THÉORIQUE. (Summary of Theoretical Electromagnetism). Paul Poincelot. Paris, Dunod, 1963. 475p.

The fundamental principles of electromagnetism are developed from Maxwell's equations and special relativity, with due consideration of methods, theorems, and solutions of problems. Electrostatics, electromagnetism, and applications of the theory are treated. (D.C.W.)

2918 INTRODUCTION — PROGRAMS FOR THE CONQUEST OF SPACE. Donald P. LeGalley (Space Technology Labs., Redondo Beach, Calif.). p.1-42 of "Space Physics." New York, John Wiley & Sons, 1964.

Planned and completed programs for space-probe and satellite missions are reviewed. (41 references.) (T.F.H.)

2919 SPACECRAFT DESIGN FOR SCIENTIFIC MISSIONS. Carl D. Graves and Robert A. Park (Space Technology Labs., Redondo Beach, Calif.). p.45-81 of "Space Physics." New York, John Wiley & Sons, 1964.

The engineering problems associated with the design of components whose purpose is the support of experimental facilities aboard satellites and space probes are outlined. The effects of the mission, vehicle, and compatibility requirements on the mission-support components are discussed. Support components include power supplies, telemetering equipment, attitude control devices, environmental control equipment, etc. (T.F.H.)

Accelerators

2920 (BNL-8496) ELECTROSTATIC BEAM SEPARATORS AT BROOKHAVEN NATIONAL LABORATORY. James R. Sanford (Brookhaven National Lab., Upton, N. Y.). Oct. 10, 1964. Contract AT-30-2-GEN-16. 10p. (CONF-795-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From International Symposium on Insulation of High Voltage in Vacuum, Cambridge, Oct. 1964.

Measurements of the voltage-holding characteristics of the crossed-field electrostatic separators used to purify the secondary beams from the Cosmotron and AGS are described; tank pressures, magnetic fields, or voltage distributions are varied for both stainless steel and glass electrode systems. (R.E.U.)

2921 (BNL-8544) MEASUREMENTS OF R/Q IN IRIS-LOADED DEFLECTOR WAVEGUIDES. H. Hahn and H. J. Halama (Brookhaven National Lab., Upton, N. Y.). Oct. 21, 1964. Contract AT-30-2-GEN-16. 7p. (CONF-637-10). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Institute of Electrical and Electronics Engineers Region 3 Annual Meeting and Technical Conference, Clearwater, Fla., May 1964.

An iris-loaded waveguide may be used as an aberration-free deflector, for example in r-f separators for ultra-relativistic particle beams, when operated in its second passband. Quantitative prediction of the deflection properties is possible if the so-called R/Q value is known. Perturbation methods are generally used to obtain experimental R/Q values, but the intrinsic hybrid character of the deflecting mode prevents their direct application. It is shown that the deflecting force is proportional to the radial variation of the axial electric field component. On this basis, two different experimental methods are proposed and their relative merits discussed. The first relies on the interpretation of the resonant frequency shift in a shorted waveguide section, when a dielectric or metal bead is pulled in radial direction. For the other, a metal needle is displaced axially close to the irises. Both approaches require harmonic analysis, which was performed on a computer for greater accuracy. The final results are $R/Q = 1.17\ k\Omega/m \pm 17\%$ and $R/Q = 1.40\ k\Omega/m \pm 3\%$, respectively. The experimental values are then compared with theoretical predictions, based on the computation of stored energy or, alternatively, on propagating power and group velocity. A simple first-order approximation is presented. More exact computations yield $R/Q = 1.38\ k\Omega/m$ and $R/Q = 1.45\ k\Omega/m$ in good agreement with the experimental results. (auth)

2922 (BNL-8556) OPERATING ENERGIES AND FLUXES FOR THE RF SEPARATED BEAM. H. Foelsche and J. Sandweiss (Yale Univ., New Haven and Brookhaven National Lab., Upton, N. Y.). Oct. 20, 1964. Contract AT-30-2-GEN-16. 8p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Operating momenta and yields for the r-f separated beam of the AGS for various modes of operation are given. (R.E.U.)

2923 (CERN-64-45) AZIMUTHAL DISTRIBUTION OF BEAM LOSSES IN A CYCLOTRON WITH AN INTERNAL TARGET, TAKING MULTI-TRAVERSALS INTO ACCOUNT. M. Barbier and C. Perret (European Organization for Nuclear Research, Geneva). Nov. 4, 1964. 33p. Dep.(mn).

The protons scattered by the target get lost in the first quarter of a betatron oscillation wavelength. The maximum of beam deposit takes place at about one-eighth of a wavelength down from the target. In the cyclotron, the dee there acts as the main beam dump. From the relatively thin dee plate, the beam goes into the pole pieces. One sees the necessity of plating the pole faces in the dee region with low activity absorbers. Also the dummy dee receives a large quantity of particles, practically all those which have not fallen on the dee. The region of the pole pieces outside the dee is also activated, but there the activating flux is the neutron flux from the target; this is not considered. The fact that the main beam loss occurs in the dee region has also an importance for the shielding. It was found that the fraction of the beam reacting in the target is always less than 10%. The protons incident on the dee and pole pieces give rise to neutrons emitted with a broad angular distribution around the direction of incidence of the proton. It is seen that the origin of the radiation lies in the dee region, which acts as a source region for all secondary particles.

The targets that seem to utilize the beam with maximum efficiency with respect to nuclear interactions seem to be targets of the lightest elements. The target thickness does not seem to have an important role in target efficiency. Only in the case where one wants to activate thin foils will it be advisable to use as thin a target as practicable. The results obtained should be partly applicable to other machines as well, at least for the first quarter betatron wavelength downstream from target. (auth)

2924 (LA-DC-6540) MAGNETIC ANALYSIS OF IONS INVOLVED IN CURRENT LEAKING AT 700 kv. J. L. McKibben (Los Alamos Scientific Lab., N. Mex.). [1959]. Contract W-7405-eng-36. 21p. (CONF-795-2). Dep.(mn); $1.00(cy), 1(mn) OTS.

From International Symposium on Insulation of High Voltage in Vacuum, Cambridge, Oct. 1964.

Ion-exchange loading in accelerating tubes is discussed. Magnetic analyses of the ions were made to clarify mechanisms of the multiplicative processes. Reviews of experimental results for 1950, 56, and 59 are presented. It is concluded that positive ions release electrons and negative ions, and that the negative ions rather than the electrons release more positive ions. (R.E.U.)

2925 (MURA-698) NEUTRINO FLUXES WITHOUT FOCUSING AND WITH "IDEAL" FOCUSING. A. I. Galonsky (Midwestern Universities Research Assn., Stoughton, Wis.). Aug. 31, 1964. Contract AT(11-1)-384. 16p. Dep.; $1.00(cy), 1(mn) OTS.

The problems to be solved in reducing the muon shield thickness are discussed, but no solution is offered. "Ideal" focusing is defined. By direct evaluation it is found that an-order-of-magnitude increase in neutrino flux can be obtained with "ideal" focusing as compared with no-focusing. This increase is approximately independent of accelerator energy in the range 10 to 1000 Bev. (auth)

2926 (MURA-701) ON THE SUITABILITY OF THE 500-Mev FFAG SYNCHROTRON AS AN INJECTOR FOR THE AGS AND ZGS. E. M. Rowe (Midwestern Universities Research Assn., Stoughton, Wis.). Sept. 25, 1964. Contract AT(11-1)-384. 13p. Dep.; $1.00(cy), 1(mn) OTS.

A 500-Mev FFAG synchrotron was designed as a possible injector for the AGS and ZGS accelerators. In order for the FFAG to function efficiently as an injector for these machines, certain requirements as to the emittance and energy spread of the FFAG beam must be met. A number of schemes for injecting the beam from the FFAG into both the AGS and ZGS are described. Estimates as to how well these requirements are met are made for each scheme. (auth)

2927 (SLAC-PUB-56) HIGH POWER, PERMANENT MAGNET FOCUSED, S-BAND KLYSTRON FOR LINEAR ACCELERATOR USE. George K. Merdinian, J. H. Jasberg, and J. V. Lebacqz (Stanford Univ., Calif. Stanford Linear Accelerator Center). Oct. 1964. Contract [AT(04-3)-400]. 24p. (CONF-793-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Electron Devices Meeting, Washington, D. C., Oct. 1964.

The development of a permanent magnet-focused high-power S-band klystron tube to provide the r-f power for the two-mile Stanford linac is discussed. See also SLAC-PUB-48. (R.E.U.)

2928 (UCRL-11086) 0.5 Bev/c BEAM TRANSPORT SYSTEM. R. A. Swanson (California. Univ., La Jolla), G. R. Henry, and G. Schrank (Princeton Univ., N. J.). Oct. 23, 1963. Contract W-7405-eng-48. 19p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A beam transport system for externally produced pion beams was built and used for over two years at the Berkeley 184-inch cyclotron. It features a measured acceptance mean solid angle of 6.5×10^{-3} sr over a 2-in.-diameter circle. The image has negligible momentum dispersion within the accepted 7% FWHM momentum band, but an intermediate focus is dispersed to permit collimation to a narrower momentum band. (auth)

2929 SASKATCHEWAN OPENS HIGH ENERGY ACCELERATOR LAB. Can. Nucl. Technol., 14-16(1964).

The University of Saskatchewan has installed Canada's first high-energy linear electron accelerator. It is 80 feet long and is powered by S-band klystrons, each of which delivers 20 kw of r-f power (average) and 26 Mw pulsed. Details of operation are outlined, together with the areas of research to be investigated. (F.S.A.)

2930 PROBLEMS AND ADVANCES IN HIGH-ENERGY ACCELERATOR DESIGN. L. Jackson Laslett (Univ. of California, Berkeley). Phys. Today, 17: 42-8(Nov. 1964).

Difficulties and advances in the design of higher-energy proton accelerators are discussed. (D.C.W.)

2931 WAVES IN HIGH DENSITY ELECTRON BEAMS AT A FINITE FOCUSING FIELD. N. E. Belov. Radiotekhn. i Elektron., 9: 1663-74(Sept. 1964). (In Russian)

Space charge and cyclotron wave parameters for electron beams were determined for a finite focusing magnetic field and arbitrary ratios between plasma oscillation frequency and operating frequency. Excitations of high density beams were analyzed and numerical calculations are given. (tr-auth)

2932 ELECTRON BEAM FOCUSING BY PERIODIC ELECTRIC AND MAGNETIC STATIC FIELDS. A. L. Goldenberg and M. I. Petelin (Gorkii State Univ., USSR). Radiotekhn. i Elektron., 9: 1675-9(Sept. 1964). (In Russian)

The stability of electron beams moving in three-dimensional static fields is resolved by reducing the problem to two independent Hill equations. A simple method is suggested for estimating the maximum current that may be focused by periodic fields. (tr-auth)

2933 ENERGY CALIBRATION OF A HIGH-INTENSITY ELECTRON BEAM BY BACKSCATTER MEASUREMENTS. Ralph L. Belcher, J. M. McGarrity, and Joseph Silverman (Univ. of Maryland, College Park). Trans. Am. Nucl. Soc., 7: 321-2(Nov. 1964).

2934 ACCELERATOR RADIATION SOURCE. William E. Mott (to Schlumberger Ltd.). U. S. Patent 3,151,243. Sept. 29, 1964. Filed Apr. 11, 1960.

A linear ion accelerator design is offered which can be inserted into a bore-hole to produce a stable neutron beam for well logging. (T.R.H.)

Astrophysics and Cosmology

Refer also to abstract 2942.

2935 (MIT-2098-96) BRUNO ROSSI'S REMARKS ON X-RAY ASTRONOMY. B. Rossi (Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science). [1963]. Contract AT(30-1)-2098. 10p. (CONF-781-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Solvay Conference, Brussels, May 1964.

Possible mechanisms of localized x-ray sources are discussed. Some experimental confirmation from rocket-borne detectors is presented. (R.E.U.)

2936 THE MOTION OF CHARGED PARTICLES IN THE VICINITY OF MAGNETIC NEUTRAL PLANES WITH APPLICATIONS TO TYPE III SOLAR RADIO BURSTS. A. A. Weiss and J. P. Wild (Commonwealth Scientific and Industrial Research Organization, Chippendale, New South Wales, Australia). Australian J. Phys., 17: 282-306(Sept. 1964).

The equations of motion for a charged particle of constant energy injected into or near a neutral plane separating two opposing magnetic fields are integrated by approximate analytical methods. The simplest relevant field configuration, with an arbitrary intensity gradient in one direction, is chosen. The trajectories of particles injected at arbitrary angles and at points in or near to the neutral plane are discussed in detail. The motions of the guiding centers and the spatial density distributions of clouds of particles are evaluated for the exponential model, in which

the vertical field intensity decreases exponentially in the vertical direction. When clouds of particles are discussed, mutual interactions of the particles are neglected, as are interactions between the particles and any background plasma that may be supposed to exist. Assuming that the sources of type III solar radio bursts are compact clouds of electrons guided by magnetic neutral planes in the solar corona, the exponential model is discussed as a possible model for type III bursts. Observed features of type III bursts are found to be consistent with the model. (auth)

2937 CALCULATION OF ENERGY DISTRIBUTIONS OF RELATIVISTIC ELECTRONS FROM THEIR SYNCHROTRON RADIATION. APPLICATION TO THE CRAB NEBULA. J. Jaeger and G. Wallis (Heinrich Hertz-Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 44-63(1960-61). (In German)

Besides the general formula for the intensity of synchrotron radiation, which is not suitable for explicit calculations, there exist a number of approximations valuable in certain frequency and energy regions. These approximative formulas together with an approximation for relativistic electrons are discussed. It is shown how they fit to solve an integral equation for the energy distribution of the radiant electrons if the frequency distribution of their synchrotron radiation is given. In some cases this approximation leads to a solution by Laplace transformation. This is convenient especially when investigating discrete cosmic radio sources. The results were applied to the optical and radio emission of the Crab Nebula. The influence of plasma on generation and propagation of synchrotron radiation was estimated. (auth)

2938 OUTLINE OF A MAGNETOHYDRODYNAMIC THEORY OF SUNSPOT PROCESSES. Max Steenbeck (Institut fur Magnetohydrodynamik, Deutsche Akademie der Wissenschaften, Jena, Ger.). Beitr. Plasmaphysik, 1: 153-78(1960-61). (In German)

The strongly turbulent plasma of the convection zone rotates with width-dependent angular velocity around the sun's axis. This in its gliding form of motion leads to two effects: one in an excited eddy current in a magnetic field occurring in the meridian direction, which produces a magnetic field in the direction of the widening circle, and the other in the magnetic field of the convection zone distorted by pushing in the plasma zones gliding together. (tr-auth)

2939 GEOMAGNETIC AND SOLAR DATA. J. Virginia Lincoln, ed. (National Bureau of Standards, Boulder, Colo.). J. Geophys. Res., 69: 4677-80(Nov. 1, 1964).

Data on geomagnetic activity in the second quarter of 1964 are tabulated, together with some similar data for 1962 and 1963. Provisional sunspot numbers for June 1964, are also included. (D.C.W.)

2940 RELATIVE ABUNDANCES OF ENERGETIC HYDROGEN ISOTOPES PRODUCED IN SOLAR FLARES. C. J. Waddington and P. S. Freier (Univ. of Minnesota, Minneapolis). Phys. Rev., 136: B1535-9(Dec. 7, 1964).

The relative abundances of protons, deuterons, and tritons were studied in photographic nuclear emulsions flown during the July 18, 1961 solar-flare event. These emulsions were exposed at a time and locality at which there was a geomagnetic threshold. The effects of this threshold on the different particles were calculated, and the resulting enrichment of the abundance ratios was used to assist in reducing the abundance limits to lower values than those previously quoted. By including the results of previous α particle measurements in these emulsions, it was found that the relative abundances of solar-produced H^1, H^2, H^3, and He above a given rigidity at this time were $1: \leq 1.4 \times 10^{-2}; \leq 2.8 \times 10^{-2}: 0.17$; and above an energy of 50 Mev per nucleon, — above a given velocity — were $1: \leq 2 \times 10^{-3}; \leq 6 \times 10^{-4}: 2.4 \times 10^{-2}$. The consequences of these observations are briefly discussed. (auth)

2941 NEUTRINO OPACITY. II. NEUTRINO-NUCLEON INTERACTIONS. John N. Bahcall and Steven C. Frautschi (California Inst. of Tech., Pasadena). Phys. Rev., 136: B1547-?(Dec. 7, 1964).

The contribution of neutrino-nucleon interactions to the neutrino opacity of matter is studied, special attention being paid to possible astrophysical applications such as supernova explosions. The results of recent accelerator experiments with high-energy neutrinos are used to show that nonresonant neutrino-nucleon scattering does not make a significant contribution to the neutrino opacity for astrophysically important conditions. The results of deep-mine cosmic-ray studies are then used to show that there are no resonances in the ν_μ-nucleon and $\overline{\nu}_\mu$-nucleon systems with masses less than 60 Bev (laboratory neutrino energies $< 2 \times 10^{+3}$ Bev), and that there are no resonances in the ν_e-nucleon and $\overline{\nu}_e$-nucleon systems with masses less than 7 Bev (laboratory neutrino energies <30 Bev). Neutrino absorption by bound nucleons is also discussed and a sum rule is proved for neutrino capture that is sufficiently accurate for most astrophysical applications. The effect of the exclusion principle on the capture cross sections is described, and some applications to specific nuclei are presented. The accelerator experiments with high-energy neutrinos are then used to show that neutrino radioactivity, — nuclear de-excitation by emission of a neutrino-antineutrino pair — is a substantially less important mechanism for stellar energy loss than was suggested by some previous estimates. (auth)

2942 NUCLEAR ENERGY SOURCES OF STARS AND THEIR HUMAN IMPLICATIONS. G. Gamow (Univ. of Colorado, Boulder). p.1-6 of "High Temperature Technology." Washington, D. C., Butterworths, 1964.

The nuclear fusion processes in the stars are briefly discussed, together with the possible use of fusion processes as energy sources for human needs. In the latter connection, suitable reactions, containment, and energy production are considered. (D.C.W.)

2943 SPACE PHYSICS AND RADIO ASTRONOMY. H. Messel and S. T. Butler, eds. London, Macmillan and Co. Ltd., 1964. 174p. 21s.

Seven review articles are included; one has been abstracted separately. The remaining six articles are concerned with radio astronomy, the science of meteors, aeronautics, and space physics. (T.F.H.)

For an abstract of the individual section see: 3004.

2944 SPACE PHYSICS. Donald P. Le Galley and Alan Rosen, eds. University of California Engineering and Physical Sciences Extension Series. New York, John Wiley & Sons, 1964. 770p. $25.00.

Eighteen papers are included; separate abstracts have been prepared for 17. One of the papers was previously abstracted in NSA, as abstract number 18: 40418. (T.F.H.)

For abstracts of individual papers see: 2190, 2585, 2918, 2919, 2945, 2946, 2947, 2948, 2949, 2950, 2951, 2952, 3003, 3170, 3171, 3172, and 3173.

2945 SOLAR PHYSICS AND SOLAR RADIATION. Lewis Larmore (Lockheed-California Co., Burbank, Calif.). p.109-26 of "Space Physics." New York, John Wiley & Sons, 1964.

The characteristics of the sun are described, including the physical properties, cyclic properties, surface features, and E-M spectra. (T.F.H.)

2946 PHYSICS OF THE PLANETS. A. G. W. Cameron (Goddard Inst. for Space Studies, New York). p.127-65 of "Space Physics." New York, John Wiley & Sons, 1964.

A review is presented of studies of: the atmospheres of Earth, Venus, Mars, Mercury, and the giant planets; the lunar surface; and the planetary interiors. 131 references. (T.F.H.)

2947 MICROMETEOROIDS. Bernard Hamermesh (Space Technology Labs., Redondo Beach, Calif.). p.270-97 of "Space Physics." New York, John Wiley & Sons, 1964.

A survey is presented of the sources of information on micrometeoroids. After an introductory discussion

of various indirect sources of data, a description of the current state of development of detectors was presented. It is noted that multiparameter detectors have to be developed if more precise data are desired, and several suggestions of such possible approaches were given. Also, a review of the direct space measurements of the micrometeoroid flux was presented. The presence of a dust cloud about the earth appears to be a definite conclusion from these measurements, and some conjectures on the origin of this cloud were discussed. The subject of micrometeoroid damage was touched on, and the associated problems of hypervelocity impact were mentioned. The difficulties encountered in the experimental and theoretical studies of hypervelocity impact were described. (auth)

2948 INTERPLANETARY MAGNETIC FIELDS. Edward J. Smith (California Inst. of Tech., Pasadena). p.350-96 of "Space Physics." New York, John Wiley & Sons, 1964.

The origins, theoretical models, perturbations and disordering, and properties of interplanetary magnetic fields are surveyed. Evidence for the existence of large-scale interplanetary fields is outlined. Observations of disturbances in the field are reported. 65 references. (T.F.H.)

2949 THE SOLAR PLASMA—ITS DETECTION MEASUREMENT AND SIGNIFICANCE. William Bernstein (Space Technology Labs., Redondo Beach, Calif.). p.397-436 of "Space Physics." New York, John Wiley & Sons, 1964.

The detection and study of the solar-produced plasma in space by indirect means (e.g., by studying geomagnetic storms, cosmic-ray data, geomagnetic-field fluctuations, upper-atmosphere heating, zodiacal light, night-sky brightness, comet-tail accelerations, and auroral-zone phenomena) is reviewed. Experimental techniques and apparatus for direct measurements of the solar plasma are also described. The results of the direct experiments are compared with theoretical predictions. The composition and significance of the solar wind are summarized. 57 references. (T.F.H.)

2950 THE SOLAR WIND AND ITS INTERACTION WITH MAGNETIC FIELDS. Frederick L. Scarf (Space Technology Labs., Redondo Beach, Calif.). p.437-73 of "Space Physics." New York, John Wiley & Sons, 1964.

Theories of the quiet-day solar wind, its interactions with the solar or interplanetary magnetic field, and the solar wind–geomagnetic field interface are discussed. The theories considered include hydrodynamic coronal models and models having stationary flows without rotation or magnetic fields. 63 references. (T.F.H.)

2951 HYDROMAGNETIC WAVES IN SPACE. Gordon J. F. MacDonald (Univ. of California, Los Angeles). p.474-502 of "Space Physics." New York, John Wiley & Sons, 1964.

The theory of hydromagnetic waves in space, the magnetosphere, and at the Earth's surface is summarized. 35 references. (T.F.H.)

2952 ENERGETIC SOLAR PARTICLES. Kinsey A. Anderson (Univ. of California, Berkeley). p.611-58 of "Space Physics." New York, John Wiley & Sons, 1964.

A survey is presented of the properties and astrophysical implications of solar high-energy-particle emission. Experimental results are reviewed and compared with various theoretical models. The effect of the high-energy particles on planetary atmospheres are also investigated. 46 references. (T.F.H.)

2953 THE COMPOSITION OF SOLAR PARTICLE RADIATION. S. Biswas (Tata Inst. of Fundamental Research, Bombay). p.43-69 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

Observations on the energy and rigidity spectra of solar particles and their relative abundances are summarized. The relative abundances are compared with those of the sun and the galactic cosmic radiation. The amount of matter traversed by the solar particles is also considered. (D.C.W.)

2954 ENERGETIC DEUTERONS AND TRITONS PRODUCED BY SOLAR FLARES. P. S. Freier and C. J. Weddington (Univ. of Minnesota, Minneapolis). p.139-41 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

The hydrogen isotope abundances of the energetic particles produced during the solar event of July 1961 were investigated by balloon exposure of nuclear emulsions over Minnesota at a time at which a geomagnetic cutoff was still acting. The theoretical bases for the experiment are summarized, together with preliminary results. (D.C.W.)

2955 THEORY OF THE SOLAR WIND. E. N. Parker (Univ. of Chicago. p.173-84 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

It is shown that hydrodynamic expansion of the solar corona determines the gross features of the interplanetary magnetic field and the cosmic-ray variations. The uniqueness of the supersonic expansion solutions for the corona is proved, establishing that the only stationary state of a stellar corona the outer regions of which are supplied at least by thermal conduction is one of hydrodynamic expansion to supersonic velocity at a large distance from the star. (D.C.W.)

2956 THE SOLAR WIND VELOCITY AND ITS CORRELATION WITH GEOMAGNETIC, SOLAR AND COSMIC RAY ACTIVITY. Conway W. Snyder (California Inst. of Tech., Pasadena), M. Neugebauer, and U. R. Rao. p.185-9 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

The correlation of plasma velocity measured by Mariner II with various indices of solar and terrestrial activity during more than 4.5 solar rotations is discussed. (D.C.W.)

2957 INTENSITY OF GREEN CORONAL EMISSION AND THE VELOCITY OF PLASMA WIND. G. L. Pai and V. A. Sarabhai (Physical Research Lab., Ahmedabad, India). p.190-7 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

The basic validity of a model in which magnetic cavities and turbulent regions in interplanetary space arise from longitudinal velocity gradients and time variation of the solar wind velocity is demonstrated, assuming that the solar wind velocity $v = f(\lambda)$, where λ is the intensity of the 5303-Å coronal emission. (D.C.W.)

2958 DIRECT OBSERVATIONS OF THE SOLAR WIND BY THE MARINER II SPACECRAFT. Conway W. Snyder and Marcia Neugebauer (California Inst. of Tech., Pasadena). p.210-19 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

The relation between the high-velocity plasma streams and the active regions on the sun is discussed on the basis of Mariner II observations. The results of detailed calculations of the plasma temperature and velocity are considered, illustrating the tendency of the solar wind to exhibit very sudden repeated increases in velocity. (D.C.W.)

2959 SOLAR COSMIC RAYS AND INTERPLANETARY MAGNETIC FIELD. G. F. Krymskii and A. I. Kuzmin (Inst. of Cosmophysical Research and Aeronomy, Yakutsk, USSR). p.226-9 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

The difference in the arrival time of soft cosmic rays from chromospheric flares in the northern and southern hemisphere of the sun, as detected by solar absorption of radio waves in the ionosphere, is discussed. (D.C.W.)

Atomic Physics

2960 (IS-743) MULTIPACTORING AT A SINGLE ELECTRODE. Donald Ray Finch and E. L. Iloff (Ames

Lab., Ames, Iowa). Aug. 1963. Contract W-7405-eng-82. 118p. Dep.; $4.00(cy), 3(mn) OTS.

A new type of electron multiplying phenomenon that occurs at the surface of a single flat plate electrode is described. The process occurs in a combined d-c and vhf field and is of the type commonly known as multipactoring. Electrons move outward from a multiplying electrode under the influence of the vhf field which is larger in magnitude than the d-c field. After the vhf field reverses the electrons stop and are accelerated back to the multiplying electrode by the combined fields. Upon striking the multiplying electrode more than one secondary electron is emitted which under the proper conditions can repeat the above motion yielding ultimately a large increase in number of electrons. A simple theory of the mechanism is presented which includes conditions for stability of the multiplying process as well as a description of the motion of the electrons in the process. A method of specifying all field parameters is presented which enables these parameters to be quickly specified for experimental work. The experimental work presents a good verification of the theory of the mechanism; in particular, the stability conditions are well confirmed from the experimental results. A discussion of competing types of gas discharges and multiplying mechanisms is presented which enables a clear understanding of the detailed mechanisms that are occurring to be achieved. (auth)

2961 (LADC-6146) ANOMALOUS DISPERSION CORRECTIONS COMPUTED FROM RELATIVISTIC HARTREE-DIRAC-SLATER WAVE FUNCTIONS. Don T. Cromer (Los Alamos Scientific Lab., N. Mex.). [1964]. Contract W-7405-eng-36. 27p. Dep.(mn); $2.00(cy), 1(mn) OTS.

The real and imaginary anomalous dispersion terms, $\Delta f'$ and $\Delta f''$, were computed for elements of z = 10 through 98 for five commonly used x-ray wavelengths. Oscillator strengths were calculated from relativistic Hartree-Dirac wave functions that include Slater's approximate exchange correction as modified by Latter. (auth)

2962 (UCRL-11628) THE VARIATIONAL METHOD IN ELECTRON-HYDROGEN SCATTERING (thesis). Robert Louis Armstead (California. Univ., Berkeley. Lawrence Radiation Lab.). Sept. 3, 1964. Contract W-7405-eng-48. 57p. Dep.(mn); $3.00(cy), 1(mn) OTS.

The Kohn variational principle is used to calculate p-wave phase shifts for the elastic scattering of electrons from a neutral hydrogen atom at sub-excitation energies. The trial wave function is represented on a basis that simplifies algebraic and numerical work. It is found that a careful treatment avoids the usual pitfalls of variational scattering calculations and yields quite accurate results. Singlet and triplet p-wave phase shifts are tabulated and compared with other calculations. Similar calculations for s-wave and p-wave positron-hydrogen scattering are carried out and tabulated. (auth)

2963 (UCRL-11636) STUDY OF OPTICAL-PUMPING TRANSIENTS IN RUBIDIUM AND CESIUM VAPORS. Joseph Yellin, Richard Marrus, and W. A. Nierenberg (California. Univ., Berkeley and California. Univ., Berkeley. Lawrence Radiation Lab.). Sept. 4, 1964. Contract W-7405-eng-48. 19p. Dep.; $1.00(cy), 1(mn) OTS.

The shapes of optical-pumping transients in rubidium vapor were studied in detail. Observed transients can be separated into a sum of exponential components. These components are found to be in agreement with a theoretical model based on complete mixing in the excited state. From a study of the times of the individual components as a function of light intensity, relaxation times can be deduced. (auth)

2964 EFFECT OF HEAVY ATOMS ON STATISTICS OF DISTRIBUTION OF X-RAY REFLECTION INTENSITIES IN THE CASE OF HYPERSYMMETRY. Y. Gobillon and M. Van Meerssche (Université, Louvain, Belg.). Bull. Classe Sci., Acad. Roy. Belg. (5), 189-93(1964). (In French)

The analysis of the statistical distribution of the reflection intensities of x rays, proposed by Rogers and Wilson for crystals in which the structure is hypersymmetric, is extended to the case in which the cell is formed of atoms of unequal weight. (tr-auth)

2965 THE INFLUENCE OF DISTORTION AND NOISE ON THE MEASUREMENT OF MULTIPLE COULOMB SCATTERING IN A NUCLEAR EMULSION AND THEIR ELIMINATION. Ching-ju Jen. Chung Kuo K'o Hsueh, 13: 221-30(1964).

Studies were made on the effects of emulsion distortions on the measurement of multiple Coulomb scattering. A criterion is given for the proper selection of cell lengths when measuring under different conditions. An attempt was made to apply a measuring method using small cells (the center of gravity method), which reduces the effect of noise, to the high-energy region ($P\beta C \approx$ several billion electron volts) and a satisfactory result was obtained. In this way, an effective method was developed for accurate measurement of particle energy in the high-energy region. The small-cell measuring method (center of gravity method) was combined with the method of highest coordinate differences, with results in good agreement with experimental data. By this method, distortions can be effectively eliminated, and it may also be employed in the measurement of oblique traces, thus creating the possibility of expanding the area of oblique trace measurement. (OTS)

2966 MEASUREMENT OF HYPERFINE STRUCTURE OF CADMIUM LEVELS EXCITED BY ELECTRON BOMBARDMENT. Mireille Barrat (Faculte des Sciences, Caen, France). Compt. Rend., 259: 1504-6(Aug. 24, 1964). (In French)

The hyperfine structures of some excited levels of the Cd atom and Cd^+ excited by electron bombardment were determined by magnetic resonance. The 5^1D_2 and 6^1D_2 levels of the Cd atom and the $(4\underline{d}^9\ 5\underline{s}^2)^2D_{\frac{5}{2}}$ level of Cd^+ were studied. The precision was considered mediocre and no anomalies of the hfs could be measured. The results are given and discussed. (J.S.R.)

2967 POSITRONIUM PRODUCTION REACTIONS IN GASES. M. Gmitro (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Rez). Czech. J. Phys., 14: 817-23(1964). (In Russian)

The investigation of positronium angular distributions in the positron-positronium pick-up reactions in gases is considered as a method for studying electron wave functions in molecules. The methods of direct nuclear reactions were used. The basic approximation of the present paper is the Born approximation. Angular distributions are distinguished by reactions with electrons from "atomic" and "molecular" orbits. The most advantageous region of positron energy is the 20 to 100 ev region. (auth)

2968 ON THE RELATIVISTIC ATOMIC PHOTOEFFECT. V. G. Gorshkov and A. I. Mikhailov. Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1169-72(July 1964).

Angular distribution formulas for the relativistic photoeffect were developed. The formulas obtained contained a correction $(\alpha Z)^2$ in the formula for the central region of the angular distribution. Angular distribution of photoelectrons at a photon energy of 662 kev and Z = 60 and 92 and at 1332 kev and Z = 83 was plotted and analyzed. The recent data presented by Pratt and others giving the numerical calculations for photoeffect cross section on the K-shell are analyzed and correlated with the experimental results. (R.V.J.)

2969 ROTATION-ELECTRONIC INTERACTION IN THE RYDBERG STATES OF DIATOMIC MOLECULES. Ying-nan Chiu (Univ. of Chicago). J. Chem. Phys., 41: 3235-49(Nov. 15, 1964).

The theoretical foundation of Hund's coupling cases for the interaction between rotation and electronic motion was re-examined. The relationship between different cases is shown by angular-momentum coupling techniques. Rotational interaction terms neglected in the Born-Oppenheimer adiabatic type approximation and in the idealized Hund's cases are considered in particular. For application to

Rydberg states, new and improved perturbed energy expressions of Λ doubling for spectroscopic use were derived up to the fourth order for a near Hund's Case b′ diatomic molecule and up to the second order for a near Hund's Case d′ diatomic molecule. Specific formulas are given for the p-term (L = 1) and the d-term (L = 2) complexes. For the approach towards cases intermediate between b′ and d′, secular determinants for this perturbation problem are formulated starting both from ideal case b′ and from ideal case d′ using two parameters, instead of one, for the d-term complex. These two approaches are shown to give equivalent results proving the consistency of the perturbations and assumptions used at both ends. The nature of these assumptions as well as the physical basis for the transition between Case b′ and Case d′ are shown. (auth)

2970 ELECTRON-EXCITATION CROSS SECTIONS FOR HYDROGEN STATES WITH LARGE PRINCIPAL QUANTUM NUMBERS. Gene M. Cunningham and Chun C. Lin (Univ. of Oklahoma, Norman). J. Chem. Phys., 41: 3268-9(Nov. 15, 1964).

Electron-excitation cross sections were calculated for several highly excited states of the S, P, and D series of the hydrogen atom. Differential cross sections for the 20P and 20D states calculated by the modified WKB functions were found to agree with those obtained from the exact wave function to within 2%. In the case of the S states the agreement was less satisfactory; thus the WKB method was not used for these states. Data are tabulated. (P.C.H.)

2971 MEASUREMENT OF THE ENERGY DISTRIBUTION IN FIELD IONIZATION. Tien Tzou Tsong and Erwin W. Mueller (Pennsylvania State Univ., University Park). J. Chem. Phys., 41: 3279-84(Dec. 1, 1964).

The energy distribution of ions obtained by field ionization of He, Ne, Ar, and H_2 near the surface of a tungsten emitter is measured with an improved retarding potential tube. Most ions are found to originate immediately beyond the critical distance determined by the condition that the electron tunnels above the Fermi level. The ion energy is determined by the ionization energy and an image force contribution, while there is no indication of a shift of the ground level of the gas atom due to the proximity of the metal surface. In the case of hydrogen the atomic ion is found to have an additional energy of $\frac{1}{2}$ of the dissociation energy of the molecular ion. The half-width of the distribution is between 0.5 and 0.7 ev for all the above gases, indicating an extremely narrow ionization zone with a depth of a few tenths of an angstrom. Calculation of the energy distribution by applying the WKB method to a square well gives the proper general features and the temperature effect but a half-width too wide by a factor of 2, thereby exhibiting the limitation of a linear model. (auth)

2972 DESORPTION FROM METAL SURFACES BY LOW-ENERGY ELECTRONS. Dietrich Menzel and Robert Gomer (Univ. of Chicago). J. Chem. Phys., 41: 3311-28 (Dec. 1, 1964).

The effect of low-energy (15-200-ev) electrons on hydrogen, oxygen, carbon monoxide, and barium adsorbed on tungsten was investigated by a field-emission technique. Desorption cross sections σ were determined from work function and Fowler–Nordheim pre-exponential changes and are significantly smaller than would be expected for comparable molecular processes. Marked variations in cross section with binding mode within a given system were found. Thus $\sigma_H = 3.5 \times 10^{-20}$ cm^2 and 5×10^{-21} cm^2 for processes tentatively interpreted as the splitting of molecularly adsorbed H_2 and desorption of H, respectively; $\sigma_\beta = 4.5 \times 10^{-19}$ cm^2 for a loosely bound state and $\sigma_\beta \leq 2 \times 10^{-21}$ cm^2 for all other states; $\sigma_{Ba} < 2 \times 10^{-22}$ cm^2 under all conditions. In the case of CO (reported in detail elsewhere), three binding modes observed previously could be confirmed and differentiated by their different cross sections: $\sigma_{virgin} = 3 \times 10^{-19}$ cm^2; $\sigma_\beta = 5.8 \times 10^{-21}$ cm^2, $\sigma_\alpha = 3 \times 10^{-18}$ cm^2; conversion by electrons of virgin to $\beta \sigma_{v\beta} \geq 10^{-19}$ cm^2. These results are interpreted in terms of transitions from the adsorbed ground state to repulsive portions of excited states, followed by de-exciting transitions which prevent desorption. Arguments are made to show that the excitation cross sections should be essentially normal, i.e., $\sim 10^{-16}$ to 10^{-17} cm^2, and that the much smaller over-all cross sections observed are due to high transition probabilities to the ground state, estimated as 10^{14} to 10^{15} sec^{-1}. A detailed calculation for the case of exponentially varying transition probabilities and repulsive upper states is presented and discussed, and the variations in cross section with binding mode made plausible. It is shown that low-energy electron impact constitutes a sensitive tool for studying chemisorption. (auth)

2973 ELECTRON-IMPACT DESORPTION OF CARBON MONOXIDE FROM TUNGSTEN. Dietrich Menzel and Robert Gomer (Univ. of Chicago). J. Chem. Phys., 41: 3329-51(Dec. 1, 1964).

The low-energy electron impact desorption of CO adsorbed on W was investigated by means of a field emission technique. It was found that the previously postulated binding modes of CO could be distinguished and confirmed by their differing desorption cross sections which are $\sigma_{virgin} = 3 \times 10^{-19}$ cm^2, $\sigma_{virgin\ to\ \beta} \geq 10^{-19}$ cm^2, $\sigma_\beta \sim 3 \times 10^{-21}$ cm^2, $\sigma_\alpha = 3 \times 10^{-18}$ cm^2 for 80-v electrons. Evidence for thermal conversion of virgin states to both β and α states was obtained; electrons also seem to convert virgin to β states. In addition to desorption, dissociation with carbon formation occurred. Although quantitative estimates are difficult, the ratio of dissociation to desorption was estimated to be between 0.5 and 0.1, and seems to be least for α and greatest for β desorption. The results on carbon formation show that (at least) a large fraction of CO in the α and virgin modes is adsorbed with the C end of the molecule only. It is pointed out that electron desorption is a sensitive tool for probing chemisorption states and is able to reveal details like interconversion which are not readily detectable by other means. (auth)

2974 STUDY OF THE BORN-OPPENHEIMER APPROXIMATION WITH APPLICATION TO H_2. George A. Fisk and Bernard Kirtman (Univ. of California, Berkeley). J. Chem. Phys., 41: 3516-21(Dec. 1, 1964).

A method for evaluating energy corrections due to breakdown of the Born–Oppenheimer (BO) approximation in ordinary diatomic molecules was developed. It is shown that the effective potential for nuclear motion depends upon both the vibrational momentum and the internuclear distance. Energy levels for H_2 were calculated by numerical solution of the Schrödinger equation for motion in this effective potential. The v = 0 level is shifted ~0.2 cm^{-1} by non-BO terms as compared to the total anharmonicity correction of about 30 cm^{-1}. This shift is an order of magnitude too small to explain the difference between the best theoretical and experimental values of D_0^0. (auth)

2975 CORRELATION ENERGY OF TWO-ELECTRON SYSTEMS. J. L. J. Rosenfeld and Daniel D. Konowalow (Univ. of Wisconsin, Madison). J. Chem. Phys., 41: 3556-9 (Dec. 1, 1964).

Correlated closed-shell and open-shell functions (due to Roothaan and Weiss) were analyzed in terms of a $1/Z$ expansion to obtain the corresponding first-order wavefunctions and the second-order energy. The need for expanding the open-shell functions in powers of $Z^{-\frac{1}{2}}$ is demonstrated. The contributions to the second-order energy from radial and angular correlation were estimated. (auth)

2976 SOME PROPERTIES OF THE PAIR DISTRIBUTION FUNCTION. Morikazu Toda (Tokyo Univ.). J. Phys. Soc. Japan, 19: 1550-4(Sept. 1964).

Thermodynamical consideration on the equation of state is combined with kinematical consideration of the two-body distribution function. Thus, general relations between the equation of state and the distribution function are obtained without using statistical mechanics, and the fact that spatial correlation between molecules is responsible for the pressure equation is emphasized. The results are applied to classical systems and to quantum-mechanical gases, and are verified by statistical mechanics. (auth)

2977 SOME MEASUREMENTS ON DEPOLARIZATION AND SCATTERING OF ELECTRONS IN THICK

ABSORBERS. J. van Klinken, K. Bulthuis, and R. J. van Duinen (Rijksuniversiteit, Groningen, Netherlands). Nucl. Phys., 61: 593-600(Jan. 1965).

Measurements are reported on depolarization of 280- to 1750-kev beta particles passing through thick absorbers; for electrons emerging parallel to the incident beam the degree of polarization is measured with a calibrated Mott analyzer. The depolarization proves to be strongly Z dependent. In Lucite ($\bar{Z} = 3.6$), little depolarization is observed, even for an energy reduction from 1.75 to 0.26 Mev in a 5.2-mm thick absorber. In gold, the observed depolarizations with moderate energy reduction in relatively thin absorbers are already of 40 to 50%. These large values are not explained by the present theories. The angular distributions of 270-kev electrons scattered and slowed down by a thick Lucite and a thick gold absorber are also different, yielding a most probable scattering angle of 27° in Lucite and 37° in gold. (auth)

2978 SPECTRA INDUCED BY H^+ IMPACT ON O_2. R. H. Hughes and D. K. W. Ng (Univ. of Arkansas, Fayetteville). Phys. Rev., 136: A1222-4(Nov. 30, 1964).

Spectra induced by 5- to 130-kev H^+ impact on O_2 have been observed in the visible region. Principal features are O_2^+, O^+, and hydrogen Balmer emissions. Absolute cross sections have been determined for excitation of the (0,0), (0,1), (1,0), (2,0), (3,1), and (2,1) bands of the $b^4\Sigma - a^4\Pi$ first negative system of O_2^+. Cross sections for populating the v = 0, 1, 2, and 3 levels of the $b^4\Sigma$ state of O_2^+ have been estimated. Cross sections for exciting some O_{II} lines have also been determined. (auth)

2979 MOLECULAR-BEAM MAGNETIC-RESONANCE STUDIES OF THE NITROGEN MOLECULE. Sunney I. Chan, Milton R. Baker, and Norman F. Ramsey (Harvard Univ., Cambridge, Mass.). Phys. Rev., 136: A1224-8(Nov. 30, 1964).

The radio-frequency spectra corresponding to the reorientations of the ^{15}N nuclear moment and the molecular rotational magnetic moment have been studied in $^{15}N_2$ by the molecular-beam magnetic-resonance method. A magnetic-resonance molecular-beam apparatus with an electron-bombardment detector was used for the experiments. In order to study these small moments, very narrow multiple slits were employed. The intensity of the molecular beam was maintained at the normal level through the use of multiple beams. From an analysis of the ^{15}N resonance, the magnitude of the spin-rotational constant for the ^{15}N nucleus was determined to be 22 ± 1 kc. This result can be shown to be consistent with available nitrogen chemical-shift data when the sign of the spin-rotational constant is positive. The magnitude of the rotational magnetic moment was found to be 0.2593 ± 0.0005 nuclear magnetons per rotational quantum number. (auth)

2980 TOTAL CROSS SECTIONS FOR THE SCATTERING OF POTASSIUM BY He, Ne, Ar, Xe, AND H_2 IN THE THERMAL ENERGY RANGE. Kotusingh Lulla, Howard Howland Brown, and Benjamin Bederson (New York Univ., New York). Phys. Rev., 136: A1233-9(Nov. 30, 1964).

Absolute values of the cross sections for the scattering of potassium by helium, neon, argon, xenon and molecular hydrogen have been determined in the thermal energy range. The atomic beam was velocity-selected using a Stern-Gerlach magnet with a resolution of approximately 10%. A capillary flow method was used to determine the target-gas density with reasonably high accuracy. Temperature effects of the target gas were taken into account; and the target-gas temperature was varied to extend the relative-velocity range employed. The potential constants for K–Ar and K–Xe are in reasonable agreement with those obtained from other cross-section measurements. The values obtained for K–Ar, K–Xe, and K–H_2 are 571.6, 1024, and 106.2 ($\times 10^{-40}$ erg cm^6) respectively; K–Ne exhibits an approximate v^{-5} velocity dependence over the range 400 to 1450 m/sec; while the K–He cross section is essentially velocity-independent over the range 650 to 2000 m/sec. (auth)

2981 PRODUCTION AND EFFECTS OF LOW-ENERGY ELECTRONS IN HELIUM. Robert H. McFarland (Univ. of California, Livermore). Phys. Rev., 136: A1240-4 (Nov. 30, 1964). (UCRL-7772)

Three low-energy electron guns have been constructed and tested, using the elastic scattering resonance in helium to determine the energy resolution of the electron beam. Additional threshold excitation measurements have been made in an attempt to produce a comprehensive study involving the effectiveness of microampere-level low-energy beams for producing metastable atoms and optically observable allowed transitions. The resulting data are presented. In addition, a second elastic resonance in helium has been observed, and the two resonances have been determined to be at 19.52 ± 0.1 and 20.30 ± 0.1 v. (auth)

2982 EXPERIMENTS ON THE PRODUCTION AND EXTINCTION OF THE 2s STATE OF THE HYDROGEN ATOM. A. I. Sellin (Univ. of Chicago). Phys. Rev., 136: A1245-53(Nov. 30, 1964).

The rates of production and extinction of the metastable 2s state of the hydrogen atom during passage of an initially pure proton beam through molecular hydrogen are studied. Iodine-filled Geiger counters were used to detect the Lyman alpha radiation from the metastable beam component, which was quenched by electric fields for purposes of observation. An observed peak in the growth of the metastable beam component at 15 kev projectile energy leads to a cross section for the extinction of the metastable atom by collision with molecular hydrogen in excess of 10^{-15} cm^2 per target atom. The rate of extinction of the metastable atom by d-c electric fields between 50 and 500 v/cm is studied and the weak-field time-independent perturbation-theory treatment of this process is verified. This extinction rate is obtained by observing the decay length of the Lyman alpha radiation emerging from the metastable beam component as a function of electric field. The effective cross section for electron capture into the 2s state by 15-kev protons in hydrogen is compared with the best available cross section for the process $e + H_2 \rightarrow$ countable u-v, and is estimated to be 1×10^{-17} cm^2 per target atom. For the same energy and target, the effective cross section for excitation of 1s projectiles to the 2s state is estimated to be 1.5×10^{-18} cm^2 per target atom. (auth)

2983 SMALL-ANGLE SCATTERING OBSERVED IN THE FORMATION OF NEUTRAL ATOMS FROM 10- TO 55-kev POSITIVE ION BEAMS. A. B. Wittkower, P. H. Rose, R. P. Bastide, and N. B. Brooks (High Voltage Engineering Corp., Burlington, Mass.). Phys. Rev., 136: A1254-9(Nov. 30, 1964).

Beams of H^+, D^+, He^+, and N^+ from 10 to 55 kev were passed through a small aperture at the entrance of a charge-changing gas target, where neutral atoms were formed by electron attachment. The attachment scattering was measured by scanning the neutral beam beyond the target cell. The increase in beam diameter was measured as a function of the target thickness. It was found that the scattering approximated a normal distribution, and the half-width at half-maximum was used to describe the attachment scattering angle. This angle, which was about one milliradian, was measured as a function of the energy and target thickness for a number of scattering gases. (auth)

2984 STOPPING OF DYSPROSIUM IONS IN GASES AND ALUMINUM. Jacob Gilat and John M. Alexander (Univ. of California, Berkeley). Phys. Rev., 136: B1298-1305(Dec. 7, 1964). (UCRL-11055)

The stopping of Dy recoils of 6 to 21 Mev in D_2, He, N_2, Ne, Ar, Kr, and Xe was studied by electrostatic collection. The range-energy data (along with previous results for Al and H_2) are compared with stopping theory. Range straggling due to the stopping process was measured for the heavier gases. The magnitude of the electronic stopping was estimated from range data, and independently of straggling data. The estimates indicate that electronic stopping can not be adequately approximated as being proportional to velocity. (auth)

2985 MOMENTUM-TRANSFER CROSS SECTIONS FOR SLOW ELECTRONS IN He, Ar, Kr, AND Xe FROM TRANSPORT COEFFICIENTS. L. S. Frost and A. V.

Phelps (Westinghouse Electric Corp., Pittsburgh). Phys. Rev., 136: A1538-45(Dec. 14, 1964).

Momentum-transfer cross sections for electrons in He, Ar, Kr, and Xe are obtained from a comparison of theoretical and experimental values of the drift velocities and of the ratio of the diffusion coefficient to the mobility coefficient for electrons in these gases. The theoretical transport coefficients are obtained by calculating accurate electron-energy distribution functions for energies below excitation using an assumed energy-dependent momentum-transfer cross section. The resulting theoretical values are compared with the available experimental data and adjustments made in the assumed cross sections until good agreement is obtained. The final momentum cross section for helium is $5.0 \pm 0.1 \times 10^{-16}$ cm^2 for an electron energy of 5×10^{-3} ev and rises to $6.6 \pm 0.3 \times 10^{-16}$ cm^2 for energies near 1 ev. The cross sections obtained for Ar, Kr, and Xe decrease from 6×10^{-16}, 2.6×10^{-15}, and 10^{-14} cm^2, respectively, at 0.01 ev to minimum values of 1.5×10^{-17} cm^2 at 0.3 ev for Ar, 5×10^{-17} cm^2 at 0.65 ev for Kr, and 1.2×10^{-16} cm^2 at 0.6 ev for Xe. The agreement of the very-low-energy results with the effective-range theory of electron scattering is good. (auth)

2986 SCREENING EFFECTS IN ELASTIC ELECTRON SCATTERING. Elmar Zeitler (Armed Forces Inst. of Pathology, Washington, D. C.) and Haakon Olsen. Phys. Rev., 136: A1546-52(Dec. 14, 1964).

In elastic electron scattering atomic screening is shown to affect the cross section both at very small and at very large angles. However, for energies above approximately 200 kev the large-angle screening effects are small, and the cross section may be written as a product of two factors, one depending on the screening effect only and the other on the spin and relativistic effects only. The cross section thus obtained is shown to be in good agreement with previous exact numerical calculations for all angles and all elements. Approximate expressions for large-angle scattering are obtained. (auth)

2987 LYMAN-ALPHA EMISSION CROSS SECTIONS FOR H_2^+ AND D_2^+ COLLISIONS WITH THE RARE GASES. B. van Zyl, D. Jaecks, D. Pretzer, and R. Geballe (Univ. of Washington, Seattle). Phys. Rev., 136: A1561-5(Dec. 14, 1964).

Cross sections for the emission of Lyman-alpha radiation resulting from H_2^+- and D_2^+-rare-gas collisions were measured in the energy range from 1 to 25 kev. Excited states of the H or D atoms which decay via the 2p-1s Lyman-alpha transition result from charge transfer to antibonding states of the H_2 or D_2 molecules or from direct excitation to antibonding states of the molecular-ion projectiles. The D_2^+ cross sections are similar to those for H_2^+ when plotted at equivalent projectile velocities. The results are compared with earlier measurements of the Lyman-alpha emission cross sections resulting from H^+ and D^+ collisions with rare gases and with the total charge-transfer cross sections for the H_2^+-rare-gas systems. (auth)

2988 DETERMINATION OF THE RANGE OF FAST, HEAVY IONS IN SOLIDS. H. Lutz and R. Sizmann (Technische Hochschule, Munich). Z. Naturforsch., 19a: 1079-89(Sept. 1964). (In German)

The range of fast heavy particles in solids was determined by a sensitive method (removal of thin surface layers by low-energy sputtering). The range distributions in various directions of copper single crystals were measured using ^{86}Kr ions of energies between 25 and 150 kev. The mean range in ⟨111⟩ fits the general range vs. energy relation given by Lindhard and Scharff. In ⟨100⟩ and especially in ⟨110⟩, the range distributions showed long tails, which increased the mean penetration of the krypton ions in these directions. These "super ranges" were caused by so-called stenons, i. e. ions which move in the structural "channels" of the fcc lattice. (auth)

Cosmic Radiation

Refer also to abstract 2190.

2989 MAGNETIC RIGIDITY DEPENDENCE OF ELEVEN-YEAR VARIATION IN COSMIC RAY INTENSITY. T. Mathews (Makerere University Coll., Kampala, E. Africa) and M. Kodama. J. Geophys. Res., 69: 4429-34(Nov. 1, 1964).

Sea level neutron monitor latitude surveys carried out at the times of solar minimum and solar maximum are compared. The data, suitably normalized with reference to a high latitude neutron monitor, are used to arrive at the fractional decrease in primary flux between these periods as a function of magnetic rigidity up to 15 Gv. (auth)

2990 ISOTOPIC COMPOSITION OF LOW ENERGY HYDROGEN NUCLEI IN THE PRIMARY COSMIC RADIATION. G. D. Badhwar (Univ. of Rochester, N. Y.). J. Geophys. Res., 69: 4435-9(Nov. 1, 1964). (UR-875-45)

The abundance of low-energy deuterons and tritons was determined in a nuclear emulsion stack exposed at Fort Churchill, Manitoba, Canada, on August 4, 1962, under 4.2 g/cm^2 of residual atmosphere. Using the grain density versus residual range method for the identification of tracks produced by particles, the differential flux of deuterons and tritons was determined. The results appear to be consistent with the absence of deuterons and tritons in the primary cosmic radiation. An upper limit was placed on the amount of hydrogen traversed by low-energy cosmic ray particles. (auth)

2991 CALCULATED SPECTRAL SENSITIVITY OF IGY AND IQSY NEUTRON MONITORS. R. M. Pearce (Univ. of Victoria, Can.) and A. G. Fowler. J. Geophys. Res., 69: 4451-5(Nov. 1, 1964).

A computer study was made of the efficiency of the IGY cosmic radiation neutron monitor and of the improved NM-64 monitor intended for the IQSY. A reactor shielding program was used to calculate the probabilities of detecting evaporation and cascade neutrons of different energies which originated in the monitor. The probability of detecting nuclear disintegrations within the monitor was then estimated using neutron multiplicities predicted by evaporation theory. The overall sensitivity and energy dependence for the two monitors are compared. (auth)

2992 ON THE RELATIONSHIP BETWEEN ABSOLUTE SOLAR COSMIC RAY INTENSITY AND RIOMETER ABSORPTION. J. A. Van Allen, W. C. Lin, and H. Leinbach (State Univ. of Iowa, Iowa City). J. Geophys. Res., 69: 4481-91(Nov. 1, 1964).

Eight separate solar cosmic ray events that occurred during 1960 were studied using observations above the atmosphere by satellite Explorer 7 of the integral omnidirectional intensity of particles J_0 ($E > E_0$), where E_0 is 30 Mev for protons and 120 Mev for α particles, and corresponding riometer values of atmospheric absorption A of cosmic radio noise at 27.6 Mc/s from College and Thule stations. The quantities $A/J_0^{\frac{1}{2}}$ and J_0/A^2 are calculated as functions of kinetic energy E for monoenergetic beams of pure protons and pure α particles. Using these results, it is shown that certain specified ranges of the experimental parameter $H(E_0) = J_0(E > E_0)/A^2$ for actual solar cosmic ray beams lead uniquely to one of the following conclusions: the atmospheric absorption is due primarily to particles of energy less than E_0, approximately equal to E_0, or greater than E_0. Observed values of H are quite different for different events during 1960, covering the range 40 to less than 10^{-2} (db^2 cm^2 sec)$^{-1}$. During a given event the prevailing tendency is for H to remain approximately constant or to decrease (sometimes markedly), but not to increase with increasing time. It is concluded that atmospheric absorption over the polar caps is often due predominantly to protons of energy less than 30 Mev and/or to α particles of energy less than 120 Mev and that the spectral form in the vicinity of these values of energy varies greatly from event to event and tends to remain about the same or to become steeper (softer) with increasing time during a given event. (auth)

2993 THE AURORALLY ASSOCIATED ABSORPTION OF COSMIC NOISE AT COLLEGE, ALASKA. Z. A. Ansari (Univ. of Alaska, College). J. Geophys. Res., 69: 4493-4513(Nov. 1, 1964).

A simultaneous study of radio-wave absorption and luminous aurora at College, Alaska, using narrow beam antennas, 5577-Å photometers, and all-sky cameras re-

sulted in the conclusion that the nighttime radio-wave absorption observed at College falls into the following two main categories. The absorption belonging to category 1 is observed at any time between 2000 and 0200h, correlates well with the intensity fluctuations of 5577 Å, and is limited to luminous regions of the sky. Included in this category is the absorption associated with the quiet as well as bright and active phases of the display. The absorption belonging to category 2 is observed only in the postmidnight hours, does not correlate with the intensity fluctuations of 5577 Å and, most probably, is not limited to luminous regions of the sky. With the absorption making a transition from category 1 to category 2, a 10- to 100-fold increase takes place in the ratio of absorption to 5577-Å intensity. The close association between radio-wave absorption and luminous aurora during absorption events of category 1 suggests that the primary particles are approximately in the energy range 10–20 kev. It is shown that the absorption associated with the quiet phase of the display is easily explained by a flux of 10^7 to 10^8 electrons cm^{-2} sec^{-1} in the range 10 to 20 kev. It is also shown that the transition from the quiet phase to the bright and active phase can be explained by a momentary 10- to 100-fold increase in the flux of low energy electrons. The lack of correlation between absorption and 5577-Å intensity fluctuations and the pronounced increase in the ratio of absorption to 5577-Å intensity observed during absorption events of category 2 are indicative of a hardening of primary particle energy spectrum, possibly because of injection of a large number of electrons in the energy range 30 to 100 kev. It is estimated that a flux of 10^6 to 10^7 electrons cm^{-2} sec^{-1} in the above energy range can adequately account for the observed absorption during events of category 2. (auth)

2994 ON THE EAST–WEST ASYMMETRY OF NUCLEAR INTERACTION COMPONENTS OF COSMIC RAYS. Charoen Dharmaphanija and Thaworn Suttipongse Chulalongkorn Univ., [Thailand]). J. Natl. Res. Council Thailand, 3: No. 3, 187-96(Sept. 1962).

Ilford G5 nuclear emulsion plates of thickness 300 microns were exposed vertically in the east-west direction at ground level at latitude 13° 46'N under 7.2 cm of lead. Part of the plates were exposed to cosmic rays from the eastern sky, while the rest were exposed to those from the western sky. The rate of increase of cosmic-ray stars was found to be higher in the westerly direction; and the east-west asymmetry of nuclear interaction components of cosmic rays based upon the number of stars greater than two prongs, was estimated to be 10%. The preponderance of the positively charged particles is attributed to protons. The frequency and size distributions of stars caused by particles coming from the eastern and the western sky are in agreement with the results of previous experiments on unshielded plates at the same locality. The slight increase of the rate of star production over that of the previous observation is discussed. (auth)

2995 PCA PHENOMENA AND COSMIC NOISE RECORDING IN THE MIDDLE REGION. W. Lippert. Monatsber. Deut. Akad. Wiss. Berlin, 6: 416-21(1964). (In German)

Extra-terrestrially diffused radio radiation of short waves (cosmic noise) was measured at geomagnetic latitude 53.4°N, geomagnetic longitude 97.5°E. Four special results can be distinguished in cosmic noise recording: sudden cosmic noise absorption (SCNA), auroral zone absorption (AZA), polar cap absorption (PCA), and sudden commencement absorption (SCA). It was previously thought that the PCA effect could not be observed at the middle latitudes, but results are presented showing this effect. (M.C.G.)

2996 HIGH ENERGY PHOTON-INITIATED E.A.S. R. Firkowski (Nuclear Research Inst., Lodz, Poland), J. Gawin, A. Zawadzki, and R. Maze. Nukleonika, 9: 373-6 (1964).

An experiment and analysis are described by which the existence of extensive air showers initiated by photons was established. (D.C.W.)

2997 KOSMICHESKIE LUCHI. (Cosmic Rays). D. V. Skobel'tsyn, ed. Tr. Fiz. Inst., Akad. Nauk SSSR, 26: 1-282 (1964). Moscow, Publishing House of Sciences, 1964.

Separate abstracts were prepared for the eight papers included. A bibliography with 600 references to literature from the period 1934–1962 is also included. (D.C.W.)

For abstracts of individual papers see: 2998, 2999, 3000, 3001, 3002, 3103, 3104, and 3105.

2998 RESULTS OF COSMIC-RAY INVESTIGATIONS CARRIED OUT BY SOVIET SATELLITES AND COSMIC ROCKETS. L. V. Kurnosova, V. I. Logachev, L. A. Razorenov, and M. I. Fradkin. Tr. Fiz. Inst., Akad. Nauk SSSR, 26: 3-16(1964). (In Russian)

Integral and differential Cherenkov counters were used for the determination of the nuclear components of the cosmic radiation. The counters employed for measuring the nuclear charge spectrum recorded the amplitude of the pulse created by the passage of a nucleus through the detector, thus determining the charge of the nucleus. Fluxes of very heavy nuclei were measured by the third Soviet earth satellite. Rough estimates based on the data obtained indicated that the flux is very small; only one nucleus with $Z > 30$ to 40 was recorded in 9 days. The instruments in the second and third space ship did not record a singie nucleus with $Z > 34$ for several days. The ratio of fluxes with $Z > 30$ to 40 and $Z > 15$ is estimated at 0.03%. The solar flares created short-lived nuclear fluxes. During the flight of the second space ship 100 nuclei with $Z > 15$, more than 3000 nuclei with $Z > 5$, and about 30,000 nuclei with $Z > 2$ were recorded. The short-range increase of the count rate can be explained by statistical deviations. During the flight of the second and third space ships, local anomalies were noted in the intensity of the radiation above the South Atlantic. The edge of the external radiation belt starting at polar regions at heights up to 2 to 300 km was found to be very unstable. The intensity of the radiation at 190 to 340 km above the surface and within +65° and – 65° was found to exceed several fold the intensity of the cosmic radiation. (TTT)

2999 EXTENSIVE ATMOSPHERIC COSMIC-RAY SHOWERS. Yu. N. Vavilov, O. I. Dovzhenko, N. M. Nesterova, S. I. Nikol'skii, A. A. Pomanskii, E. I. Tukish, and V. I. Yakovlev. Tr. Fiz. Inst., Akad. Nauk SSSR, 26: 17-117(1964). (In Russian)

The results of an investigation of extensive air showers (EAS) are presented, with consideration of specific measurements and measurement devices. The characteristics of EAS may be attributed to variations of the energy spectrum and the composition of the primary cosmic radiation or to supplementary processes involving the collisions of nucleons with energies of 10^{14} to 10^{15} ev. (D.C.W.)

3000 SEARCH FOR ~10^{13} ev PHOTONS EMITTED BY LOCAL COSMIC RADIATION SOURCES. A. E. Chudakov, V. L. Dadykin, V. I. Zatsepin, and N. M. Nesterov. Tr. Fiz. Inst., Akad. Nauk SSSR, 26: 118-41(1964). (In Russian)

A high-energy photon flux was discovered during observations made from 1960 to 1963. The experiments involved the measurement of extensive air showers under the small solid angle of a few thousandths of a steradian on the basis of the Cherenkov glow induced by them in the terrestrial atmosphere and comparing the intensity of the high-energy particles originating from various points of the celestial sphere. A high-luminosity telescopic system was used to record the Cherenkov flares from showers with the relatively low energy of about 2×10^{12} ev at sea level. In view of the large effective surface of the recording system, a good statistical accuracy was reached. Within an accuracy of 1%, in no case was an increase of the intensity noted in the vicinity of the celestial bodies examined. The results indicated an upper limit for the photon intensity at 5×10^{-11} cm sec^{-1} at photon energies $>5 \times 10^{12}$ ev. (TTT)

3001 EXPERIMENTAL DATA ON THE DEVELOPMENT OF EXTENSIVE ATMOSPHERIC SHOWERS IN THE

UPPER HALF OF THE ATMOSPHERE. R. A. Antonov, Yu. A. Smorodin, and Z. I. Tulinova. Tr. Fiz. Inst., Akad. Nauk SSSR, 26: 142-65(1964). (In Russian)

The study of the development of the extensive air showers was extended into the upper portion of the atmosphere. At great heights, the energy of the extensive air showers is carried by the first and second generation particles of the nuclear cascade, making it possible to obtain data on the fundamental characteristics concerning the interaction of very-high-energy particles. The instrumentation used included ionization chambers by which electron–photon cascades were recorded and particle densities were determined in 3 hodoscopic points, chosing showers, the axes of which possessed nearly vertical incident angles. The results indicated that the degree of energy dissipation in the case of the formation of pions in nuclear interactions is quite high as indicated by the average number of gamma quanta with $E > 10^{12}$, generated in the atmosphere in the 197 and 311 g/cm^2 layers and by the location of the maximum in the altitude function of showers with $N > 10^6$. The level of the energy dissipation was found to lie markedly higher than predicted by Landau's theory, being close to the characteristics of Heisenberg's fireball. Some fluctuations were noted in the energy transfer mechanism of the electron–photon component of the shower. The cascade mechanism played only a slight role at the upper third of the atmosphere; therefore, the data may be directly compared with the results concerning the interaction of high-energy nucleons which originate in the shower. (TTT)

3002 ATMOSPHERIC PENETRATION OF HIGH-ENERGY NUCLEONS AND PRODUCTION OF MESONS. L. T. Baradzei, V. I. Rubtsov, Yu. A. Smorodin, M. V. Solov'ev, and B. V. Tolkachev. Tr. Fiz. Inst., Akad. Nauk SSSR, 26: 224-48(1964). (In Russian)

Analysis of the data on the absorption of nucleons in the atmosphere and the secondary components created, as carried out by N. L. Grigorov, is a useful method for obtaining information on the interaction of nucleons with light nuclei. Experiments of this type, carried out since 1957 and involving the passage of 10^{12}- to 10^{14}-ev nucleons through the atmosphere, were therefore systematically examined. The values measured included the energy of the electron–photon avalanches initiated by the particles generated in nuclear interactions, particularly those due to high-energy γ quanta. The results obtained included the energy spectra of the electron–photon cascades generated by local interactions within the instrument and the spectra of the electron–photon avalanches in the air due to meson(π^0) decay events. The recording instruments were carried in airplanes to heights up to 12 km. The experimental data on the primary nucleon spectra and the absorption of the nuclear-active component in the atmosphere in the 5×10^{11}- to 10^{14}-ev range may be explained on the basis of the energy losses due to energy-independent interactions. In addition to the mechanism involved in the creation of the fireball-type pions in the range below 10^{14} ev, another mechanism is involved in the generation of pions with energies proportional to the original energy. Study of the charged-pion fluxes revealed that in the 10^{11}- to 2×10^{12}-ev range, the pions contribute markedly to the flux of the nuclear-active component. The results also show that the suppressed portion of muons in the atmosphere are formed as the result of the pion decay. (TTT)

3003 COSMIC RAYS IN SPACE. Alan Rosen and Joseph L. Vogl (Space Technology Labs., Redondo Beach, Calif.). p.659-704 of "Space Physics." New York, John Wiley & Sons, 1964.

A review is presented of galactic and extragalactic sources of cosmic radiation, acceleration mechanisms for cosmic particles, experimental cosmic-ray observations in space (and results of these observations), and the relation between cosmic-ray distributions and galactic structure. 51 references. (T.F.H.)

3004 THE VAN ALLEN BELT OF RADIATION AND THE AURORAE. H. D. Rathgeber (Univ. of Sydney). p.109-19 of "Space Physics and Radio Astronomy." London, Macmillan and Co. Ltd., 1964.

The properties and sources of the Van Allen radiation belts are reviewed. The aurorae and their connection with the Van Allen belts are also considered. (T.F.H.)

3005 INTERNATIONAL CONFERENCE ON COSMIC RAYS, JAIPUR, DECEMBER 1963, PROCEEDINGS. VOLUME 1. SOLAR PARTICLES AND SUN-EARTH RELATIONS. Under the Auspices of the International Union of Pure and Applied Physics and the Department of Atomic Energy, Government of India. R. R. Daniel, P. J. Lavakare, M. G. K. Menon, S. Naranan, N. W. Nerurkar, Yash Pal, and B. V. Sreekantan, eds. Bombay, The Commercial Printing Press Ltd., 1964. 273p. Available from Tata Inst. of Fundamental Research, Bombay.

Separate abstracts were prepared for 16 of the 19 papers included. Three papers were previously abstracted in NSA (see 18: 28201, 42252, 44671). Abstracts only were included for two papers on solar proton events of Sept. 1961 and on the applicability of the exponential rigidity spectrum to solar cosmic rays. (D.C.W.)

For abstracts of individual papers see: 2953, 2954, 2955, 2956, 2957, 2958, 2959, 3006, 3007, 3008, 3009, 3010, 3011, 3012, 3167, and 3168.

3006 RADIO ASTRONOMY OBSERVATIONS AND COSMIC RAYS. G. Swarup (Tata Inst. of Fundamental Research, Bombay). p.3-24 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tate Inst. of Fundamental Research, 1964.

Some recent observations on solar radioemission and the galactic continuum radioemission are summarized, with consideration of associated phenomena and theory. (D.C.W.)

3007 SOLAR COSMIC-RAY PROPAGATION CHARACTERISTICS. K. G. McCracken (Southwest Center for Advanced Studies, Dallas). p.83-98 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

The properties of solar cosmic radiation are summarized, and a model for the observed phenomena is outlined. (D.C.W.)

3008 RADIOACTIVITY INDUCED BY SOLAR PARTICLES. D. Lal, G. Rajagopalan, and V. S. Venkatavaradan (Tata Inst. of Fundamental Research, Bombay). p.99-136 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

Radiochemical studies of isotope production by cosmic rays in Discoverer satellite and rocket materials and in a Sputnik-4 fragment are discussed, with emphasis on the results for Discoverer XVII which was exposed to cosmic rays from the solar event of Nov. 12, 1960. The radiochemical method is also outlined. (D.C.W.)

3009 SMALL FLARES AND A NATURE OF SOLAR COSMIC-RAY PROPAGATION IN INTERPLANETARY MEDIUM. V. K. Budilov, L. I. Dorman, V. I. Ivanov, E. V. Kolomeets, and L. I. Miroshnichenko. p.144-57 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

A diffusion model for propagation of solar cosmic rays was considered. The dependence of the diffusion coefficient on the particle kinetic energy was investigated, together with the effect of motions of magnetic irregularities on the rate of density change of solar cosmic rays. The effect of small chromospheric flares in the neutron component of cosmic radiation was analyzed, and the increase of cosmic-ray intensity in the hard component during small chromospheric flares was considered. (D.C.W.)

3010 FAMILIES OF FLARE PARTICLES ON 4 MAY 1960. Robert L. Chasson (Univ. of Denver). p.161-5 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

The cosmic-ray flare event of May 4, 1960, which occurred under relatively uncomplicated interplanetary conditions, was studied. The variation of the time constant of the exponential recovery from station to station and the sharp change of the recovery characteristic occurring

after the initial exponential portion, particularly, were considered. (D.C.W.)

3011 POLAR OBSERVATIONS DURING THE 1962 AND 1963 SOLAR COSMIC-RAY EVENTS. A. J. Masley and A. D. Goedeke (Douglas Aircraft Co., Inc., Santa Monica, Calif.). p.166-9 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

The results of Antarctic observations on the absorption events of Oct. 23, 1962 and April 15, 1963 are summarized; and results for the events of Sept. 1963, obtained with 30-Mc riometers operating at conjugate stations, are presented. Satellite observations on the associated solar particles are also mentioned. (D.C.W.)

3012 FORMATION OF THE RADIATION BELTS. B. A. Tverskoi (Moscow State Univ.). p.259-63 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

A theory for the formation of the radiation belts is outlined. (D.C.W.)

Criticality Studies

3013 (LA-DC-6537) A CRITICAL MASS SURVEY OF THE $U^{235}-U^{238}-C$ SYSTEM. Ralph S. Cooper (Los Alamos Scientific Lab., N. Mex.). [1960]. Contract W-7405-eng-36. 6p. (CONF-654-14). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

A critical mass survey of the homogeneous uranium–graphite system was made for the entire range of enrichments and moderator ratios using an 18-group set of cross sections. For most of the calculations an age-diffusion code (FIRE) was used, but for small-size assemblies, S_4 transport calculations were made for comparison. At 40% enrichment the two agreed within 1% in radius down to 30 cm ($C/^{235}U = 10$) but the diffusion results were 5% larger for $C/^{235}U = 3$ (19.71 cm) and $C/^{235}U = 1$ (16.26 cm). (auth)

3014 CRITICAL DIMENSIONS OF AQUEOUS UO_2F_2 SOLUTIONS CONTAINING 4.9% URANIUM-235-ENRICHED URANIUM. E. B. Johnson and D. F. Cronin (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 301-3 (Nov. 1964).

Direct Energy Conversion

Refer also to abstracts 2467 and 3713.

3015 (AWRE-O-57/64) SILICON SOLAR CELL SPIKING. J. M. Marks (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Aug. 1964. 47p. Dep.(mn).

A description is given of the apparatus and method which are used for detecting "spiky" cells in the arrays of Si solar cells employed in the upper atmosphere fluorescence detection system. Spiking is the term applied to the behavior of cells whereby they produce internally voltage or current transients while under illumination. About 2% of cells in the four arrays examined were found to do this. The method described detects spikes of magnitude greater than a few millivolts. Suggestions are made for testing and improved assembly of cells for future arrays. No cause for this phenomenon was found during the course of the investigation, but certain relevant observations are noted. (auth)

3016 (BSD-TDR-64-107) MAGNETOGASDYNAMIC EFFECTS IN THE FLOW BEHIND A SPHERE. Research Note 415. A. Goldburg and P. O. Jarvinen (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Aug. 1964. Contract AF04(694)-414. 35p. (AD-606055). $2.00(OTS).

Maxworthy's experiments with the flight of a sphere through an incompressible electrically conducting fluid with an aligned magnetic field showed that transition in the trailing wake was moved to higher fluid mechanical Reynolds numbers. Theoretical and experimental work on suppression of vorticity in uniformly conducting incompressible fluids with imposed uniform transverse magnetic fields is analyzed to find a correlating parameter for C_D, C_f, and transition to turbulence. The parameter found in the square root of the ratio of the fluid mechanical Reynolds number (R) to the electromagnetic interaction parameter (S), $\sqrt{R/S}$, for the conditions $S \approx 0(1)$ or $RS \gg 0(1)$. The $\sqrt{R/S}$, is the Reynolds number based on the Hartmann layer thickness, $R_H = \sqrt{\rho V^2/\sigma B^2 \nu}$. It is shown that for the cases $RS \gg 0(1)$, the absolute value of R_H for transition is of the same order as the absolute value of R for transition in the zerofield case, $R_{X,O}$. Thus, the apparent effect of the transverse magnetic field in the incompressible case is to move C_D, C_f, and transition to higher values of the fluid mechanical Reynolds number, R_B, when the field is on. The apparent correlation leads to $R_B = R_0(R_0 \cdot S)$. Extension of the incompressible problem to the compressible one is based on the observed similarity of the transition processes in the hypersonic and incompressible wakes as suggested by Fay and Goldburg. Average values of the fluid properties in the base region were chosen as typical for the calculation of hypersonic wake transition Reynolds numbers, R and R_H. The presence of large amounts of easily ionizable ablation products were assumed to give Spitzer conductivity. The calculated values for the relevant nondimensional fluid mechanical and electromagnetic parameters for typical ballistic range conditions indicated they were of requisite magnitude to affect the flow. Hypersonic experiments were performed covering the range from $R \approx 5\ R_{X,0}$ with zero field to $R_H \approx 1/5\ R_{X,0}$, is the zero field wake transition Reynolds number. The magneto-hypersonic flow fields were produced by 0.22 caliber nylon pellets traveling at about 14,000 feet per second in argon through the axial magnetic field of a solenoid produced by the discharge of a capacitor bank. Drum camera pictures of the self-luminous wakes and photomultiplier traces were used as the primary diagnostic tools—the self-luminous ablation products color the wake in the same fashion as dye. The camera was oriented such that its field of view encompassed the region before and including part of the coil. In the first set of runs made at 5 cm Hg pressure, a change in the luminous structure of the flow field occurred possibly suggestive of a change from turbulent to laminar wake flow. In the second set of experiments made at 5 cm and 2 cm Hg pressure, no MHD effect on the hypersonic turbulent flow field was evident. A discussion of these results is presented. (auth)

3017 CHAPLYGIN'S TRANSFORMATION APPLIED TO MAGNETOGASDYNAMICS. E. V. Laitone (Univ. of California, Berkeley). AIAA (Am. Inst. Aeron. Astronaut.) J., 2: 1856-7(Oct. 1964).

It is shown that two-dimensional MHD flow of an infinitely conducting gas with either an aligned or transverse magnetic field can be treated more effectively using relations developed by Bers and Gelbart and the Chaplygin transformation. It is shown, particularly, that the analytical continuation through the sonic line is better expressed in terms of the Chaplygin transformation. (D.C.W.)

3018 PROGRESS IN UNCONVENTIONAL ENERGY SOURCES. K. Steimel. Elektrotech. Z., A, 83: 844-52 (1962). (In German)

After a general discussion of criteria for evaluating unusual energy converters, the principal types (solar cells, Seebeck and Peltier cells, thermionic converters, MHD generators, and fuel-element cells) are described. A special future is probable for elements in which the heat loss falls at higher temperatures since these are especially suitable for space propulsion. The MHD generators, in connection with high-temperature reactors and fuel-element cells, offer the best opportunities for conventional applications. (tr-auth)

3019 A LIQUID-METAL-PISTON MHD GENERATOR FOR LIQUID-METAL RANKINE CYCLES. J. R. Powell, J. P. Palmer, M. S. Zucker, and W. Becker (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 532-3(Nov. 1964).

3020 EMITTER MATERIALS FOR HIGH-TEMPERATURE ENERGY CONVERSION. W. B. Nottingham (Massachusetts Inst. of Tech., Cambridge). p.389-403 of "High Temperature Technology." Washington, D. C., Butterworths, 1964.

The physical principles of thermionic conversion are summarized, and the material requirements for efficient conversion are discussed with particular consideration of emitter materials. The properties of rhenium and tungsten are stressed. (D.C.W.)

3021 IMPROVEMENTS IN MAGNETOHYDRODYNAMIC DEVICES. (to Avco Corp.). British Patent 968,221. Sept. 2, 1964. Priority date Oct. 26, 1960, United States.

A magnetohydrodynamic device is designed which comprises a duct for a high-temperature electrically conductive gas, means for producing a magnetic field in the duct perpendicular to the gas flow, and opposed electrodes in communication with the gas stream. The duct is bounded by a wall structure which has a high thermal conductivity perpendicular to its surface but virtually no electrical conductivity in the plane of the wall. The wall structures comprises a plurality of thermally conductive members which are electrically insulated from one another. (D.L.C.)

3022 METHOD AND APPARATUS FOR CONVERTING IONIC ENERGY INTO ELECTRICAL ENERGY. Philip E. Ohmart (to Ohmart Corp.). U. S. Patent 3,152,254. Oct. 6, 1964. Filed June 13, 1956.

A method was developed for converting ionic energy directly into electrical current in a metallic electrical conductor. It was also found that the current so generated can be used as a co-variant for indexing or measuring one or more of the variables that are factors in the generation of current. The voltage developed from ionic energy is affected by the variable conditions, but is not affected by factors influencing the chemical asymmetry of the electrode. The surfaces of two electrically dissimilar electrodes are exposed to a plasma of ions formed by exposing an ionizable gas to ionizing radiation. One of the field variables is influenced by the condition to be indexed and an external leakage resistance is connected between the electrodes. This resistance is smaller than the critical value and the potential developed by the electrodes is measured and compared with a potential developed under known conditions. (M.C.G.)

3023 THERMIONIC ENERGY CONVERTER. Raymond Fox (to U. S. Atomic Energy Commission). U. S. Patent 3,157,802. Nov. 17, 1964.

A method of increasing the efficiency of thermionic energy conversion is described, involving the addition of a proportion of Ba vapor to the Cs vapor within a conventional diode converter. The Cs vapor provides the usual space charge neutralizing effects and the monolayer on the anode electrode of the diode for a low anode work function. The Ba provides the advantages of a cathode fractional monolayer with a stable, low work function; a relatively wider range of cathode operating temperature; and a relatively low diode pressure. (AEC)

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Refer also to abstract 2967.

3024 (JINR-P-1746) OPREDELENIE VKLADA IZOBARY 3/2,3/2 V PROTSESSY π^--p-VZAIMODEISTVIYA PRI KINETICHESKOI ENERGII π-MEZONOV 344 Mev. (A Determination of the 3/2, 3/2 Isobar Contribution to the Inelastic π^--p Interaction Processes at the Kinetic Energy of Negative Pions of 344 Mev). T. D. Blokhintseva, V. G. Grebinnik, V. A. Zhukov, A. V. Kravtsov, G. Libman, L. L. Nemenov, G. I. Selivanov, and Jung-fang Yuan (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1964. 19p. Dep.(mn).

By analyzing the difference between the π^-n and π^+n effective mass distributions of the reaction $\pi^- + p \rightarrow \pi^- + \pi^+ + n$, the contribution of the N^*_{33} isobar to the cross section of the reaction was determined. The energy of primary negative pions was 344 Mev. A similar analysis was made for the data obtained at negative pion energies of 290 and 360 Mev. The difference of the cross sections for the isobar channels shown to correspond to the transition $D_{\frac{1}{2}} - sp_{\frac{1}{2}}$ was found. A possibility of determining the $\pi\pi$-scattering lengths from the analysis of this transition is indicated. (auth)

3025 (JINR-P-1763) DVA SLUCHAYA RADIATSIONNOGO RASPADA $K^+ \rightarrow \pi^+ + \pi^0 + \gamma$. (Two Radiative Decay Events of $K^+ \rightarrow \pi^+ + \pi^0 + \gamma$). V. S. Kurbatov, E. I. Mal'tsev, A. I. Maslakov, I. V. Chuvilo, and A. I. Shklovskaya (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy). 1964. 13p. Dep.(mn).

Among 4500 K^+ decays detected in a xenon bubble chamber, two radiative K^+ decays via the channel $K^+ \rightarrow \pi^+\pi^0\gamma$ were observed. In these cases both the radiative γ-quantum and the two γ-quanta from the π^0 meson decay convert in the chamber. The kinetic energies of π^+ mesons are calculated for each case to be 97.4 and 87 Mev. The decay rate of $K^+ \rightarrow \pi^+\pi^0\gamma$ is estimated to be $\Gamma(K^+ \rightarrow \pi^+\pi^0\gamma) \approx 4.4 \times 10^{-4}$, which does not contradict the results obtained for three cases described in the literature. (auth)

3026 (JINR-P-1768) IZMERENIE VEROYATNOSTI RADIATSIONNOGO POGLOSHCHENIYA PIONOV V DEITERII. (A Measurement of the Probability of the Pion Radiative Absorption in Deuterium). M. A. Musin, V. I. Petrukhin, and Yu. D. Prokoshkin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1964. 4p. Dep.(mn).

The probability of the $\pi^-d \rightarrow 2n\gamma$ reaction was determined by comparing the γ-quanta yields from hydrogen and deuterium in the capture of negative pions. The ratio of the probabilities $S = w(\pi^-d \rightarrow 2n)/w(\pi^-d \rightarrow 2n\gamma)$ was found to be 2.8 ± 0.3, which is considerably larger than that calculated according to the data on the pion production ($S_{cal} = 1.6 \pm 0.4$). (auth)

3027 (JINR-P-1782) SECHENIE PEREZARYADKI π^--MEZONOV PRI 4 Gev/c. (Pion Charge Exchange Cross Section at 4 Gev/c). M. A. Azimov, V. S. Pantuev, L. V. Sil'vestrov, M. N. Khachaturyan, and I. V. Chuvilo (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy). 1964. 7p. Dep.(mn).

Using the Cherenkov γ-spectrometer, the cross section for the negative pion charge-exchange $\pi^- + p \rightarrow \pi^0 + n$ was measured at 4.1 Bev/c. The value of the cross section was found to be 0.12 ± 0.02 mb. (auth)

3028 (ORNL-3713) STATISTICAL MODEL CALCULATIONS OF NUCLEON-NUCLEON AND PION-NUCLEON COLLISIONS: CENTER-OF-MASS SPECTRA. R. G. Alsmiller, Jr. (Oak Ridge National Lab., Tenn.). Nov. 1964. Contract W-7405-eng-26. 42p. Dep.; $2.00(cy), 1(mn) OTS.

Statistical model calculations of nucleon-nucleon and pion-nucleon collisions were carried out for a variety of cases in the energy range 0.8 to 10 Bev. Strange particle production was not included in the calculations, and a charge analysis was not performed. (auth)

3029 (UCRL-11518) RANGE DIFFERENCES BETWEEN POSITIVE AND NEGATIVE PIONS IN EMULSION. Walter H. Barkas, W. Z. Osborne, William G. Simon, and F. M. Smith (California. Univ., Berkeley. Lawrence Radiation Lab.). June 1964. Contract W-7405-eng-48. 9p. (CONF-787-2). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 5th International Conference on Nuclear Photography, Geneva, Sept. 1964.

The velocity dependence of the range difference, which should start at zero and approach a plateau at some moderate velocity, was measured for a pion range of about 100 μ. (auth)

3030 (UCRL-11729) MULTIPION AND BARYON RESONANCES IN THE $\pi^+ + p$ REACTION. Gerson Goldhaber (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley). July 1964. Con-

tract W-7405-eng-48. 57p. (CONF-669-2). Dep.(mn); $3.00(cy), 2(mn) OTS.

From Conference on Particle Physics, Boulder, Colo., June-July 1964.

Meson–nucleon interactions leading to four particles in the final state are discussed. The reaction $\pi^+ + p \rightarrow \pi^+ + \pi^- + \pi^+ + p$ was studied at 3.65 Bev/c using a bubble chamber. Production of ρ^0 and N* are considered. (R.E.U.)

3031 (UCRL-11730) A COMPARISON OF RESONANCE FORMATION IN π^-p AND π^+p REACTIONS. Sulamith Goldhaber (California. Univ., Berkeley. Lawrence Radiation Lab.). July 1964. Contract W-7405-eng-48. 25p. (CONF-669-3). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Conference on Particle Physics, Boulder, Colo., June-July 1964.

Two- and three-particle resonances produced in peripheral collisions were used to study resonances in the reactions $(\pi^+ + p)$ and $(\pi^- + p)$ in the first-order approximation. (R.E.U.)

3032 MECHANISM OF FORMATION AND INTERACTIONS OF PARTICLES IN CARBON NUCLEUS. V. A. Belyakov, A. V. Boyadzhiev, N. M. Viryasov, and V. M. Mal'tsev (Joint Inst. for Nuclear Research, Dubna, USSR). Acta Phys. Polon., 25: 781-96(June 1964). (In Russian)

Intranuclear cascades excited in C by fast π^- mesons were calculated by the Monte-Carlo method the calculations were in good agreement with experimental data. The cascade schemes for Λ hyperons and k mesons are given. It is shown that the cascade interaction model is in agreement with experiment. Calculations of π^0 spectra were made in an attempt to resolve the source of γ quanta from the channel $\pi^0 \rightarrow 2\gamma$. (tr-auth)

3033 UNITARITY CORRECTIONS AND DISPERSION MODIFICATIONS OF ONE-PARTICLE EXCHANGE THEORIES. Michael J. Moravcsik (Univ. of California, Livermore). Ann. Phys. (N. Y.), 30: 10-31(Oct. 20, 1964). (UCRL-7778-T)

Amplitudes for elementary particle reactions calculated from a one-particle exchange theory can be modified to satisfy unitarity and to conform to the constraints of a dispersion relation. Unitarity corrections are discussed for uncoupled and coupled phases and expressions are given for the pure unitarity corrections to phases. Dispersion modifications are discussed, and it is concluded that the schemes proposed so far for such modifications are either inconsistent with the unsubtracted dispersion relations or are ambiguous in their definition of the pole contributions. The conclusion is reached that it is not possible to determine experimentally from a dispersion relation, the parameters of a one-particle exchange model. A prescription is given for obtaining the modest amount of information that can in fact be gleaned from the use of such dispersion relations. The specific and quantitative summary of conclusions is given. (auth)

3034 THE INFINITE NUMBER OF PARTICLES LIMIT OF A SOLVABLE MODEL. G. T. Schappert (Air Force Cambridge Research Lab., Bedford, Mass.). Ann. Phys. (N. Y.), 30: 119-26(Oct. 20, 1964).

The energy spectrum of a simple many body problem, which is solvable for any finite number of particles, is solved in the infinite particle number limit. The model consists of N fermions, in two N-fold degenerate levels, interacting through a monopole-monopole force of strength V. The hamiltonian can be written in terms of ordinary angular momentum operators, and for a given N, the finite matrix representation can in principle be diagonalized. The limit $N \rightarrow \infty$, but NV finite, is investigated from the point of view of diagonalizing the resulting infinite matrix. The complete energy spectrum is obtained, and the first excited state agrees with the results obtained by various other techniques. (auth)

3035 PERIPHERAL N-N INTERACTIONS AT HIGH ENERGIES. P. Smrz (Inst. of Physics, Prague). Czech. J. Phys., 14: 805-9(1964). (In Russian)

A method for determining the kinematic dependence of full cross sections of πN reactions in the virtual one-meson approximation is proposed. Results of the computation for 9-Bev NN reactions are given. (auth)

3036 A MULTI-CHANNEL MODEL OF WEAK SCATTERING OF LEPTONS. A. Vancura (Technical Univ., Prague). Czech. J. Phys., 14: 810-16(1964).

A multi-channel model of weak scattering is developed, based on the four-fermion theory of weak interactions using the Bethe-Salpeter equation. The model leads to several relations among the cross sections of different weak scattering processes. In the low-energy limit the cross sections of all included reactions are expressed with the help of a single constant. (auth)

3037 INTERACTIONS OF NUCLEAR-ACTIVE HIGH-ENERGY PARTICLES WITH LIGHT HIGHLY ELASTIC ATOMIC NUCLEI. Kh. P. Babayan, M. L. Grigorov, E. A. Mamidzhan, and V. Ya. Shestoperov (Inst. of Physics, Erevan; Moscow State Univ.; and Erevan State Univ.). Dokl. Akad. Nauk Arm. SSR, 38: 9-15(1964). (In Russian)

Experiments on the interactions of high-energy particles with light atomic nuclei were carried out at an altitude of 3200 m. Studies of the nuclear-active components of young atmospheric showers showed that with the energy of particles, $E_0 \geq 1.7 \times 10^{12}$ ev, interaction occurs between the particles and nuclei of the air with the probability of 0.11 to 0.27. It was found that, in this process, ~70% of the energy of the primary particle is transmitted to π^0 mesons. (M.C.G.)

3038 EXCITATION OF ELECTROMAGNETIC WAVES IN PLANE SEMIINFINITE WAVEGUIDE BY A CHARGED PARTICLE. Yu. M. Aivazyan and D. M. Sedrakyan (Central Scientific-Research Lab. in Physics and Tech., Academy of Sciences, Armenian SSR). Dokl. Akad. Nauk Arm. SSR, 39: 81-5(1964). (In Russian)

3039 TAKING INTO ACCOUNT DAMPING IN WEAK INTERACTIONS. A. A. Sokolov, Yu. P. Ivanov, Yu. G. Pavlenko, and B. K. Kerimov (Moscow State Univ.). Dokl. Akad. Nauk SSSR, 157: 1096-9(Aug. 11, 1964). (In Russian)

A 4-component neutrino theory was developed to explain the nonconservation of parity in processes involving a neutrino with a definite spin orientation. A positive lepton charge was assigned to e^-, μ^+, ν_L, (the usual neutrino with spin to the left), and ν'_R (the muon neutrino). A negative charge was assigned to e^+, μ^-, $\bar{\nu}_R$ (the antineutrino with spin to the right), and $\bar{\nu}'_L$ (the muon antineutrino). The process of νe-scattering (or $\nu'\mu$-scattering) in the 4-component theory was considered according to damping theory. The amplitude of the process calculated by perturbation theory leads to divergent results at high energies, since the total cross-section increases in proportion to the energy of the neutrino at high energies of $E_\nu > 10^3$ Bev, and the use of perturbation theory becomes illegitimate because the weak interaction is no longer weak. This difficulty does not arise in damping theory. Summation of the series is simplified by using the d-functions of Wigner to break down the matrix element into orthogonal combinations, which is required to solve the damping equations. The results show that the neutrino is not scattered, when the initial particle spins are parallel. If the spins are antiparallel, the electrons also remain longitudinally polarized in the center-of-inertia system, and maintain their original spin. The cross-section attains a maximum for the antineutrino with parallel particle spins before scattering, and goes to a minimum with antiparallel spins. (TTT)

3040 THE Ω^- HYPERON AND THE SYMMETRIES OF THE STRONG INTERACTION. Gyoergy Bozoki and Elemer Nagy. Fiz. Szemle, 14: 201-5(July 1964). (In Hungarian)

The recent discovery of the hyperon (Ω^-) represents the fulfillment of a theoretical prediction and leads to the hope that the theory will be helpful in creating an order among the recently discovered elementary particles, playing the same role as the periodic system of elements and the theory of spectral lines. The particles are subject to decay and have an average life of the order of 10^{-10} sec; the stable proton is always found among the decay products of baryons. E. Wigner recognized that this is due to the symmetry properties of the interactions, leading to a constant

value B, the charge of the baryon. The conservation of B indicates that the number of nucleons and subnucleons does not change during the interaction of elementary particles. Y. Ohnuki developed further this theory and Gell-Mann succeeded to locate the $\frac{3}{2}$ spin baryon resonances in a regular triangular lattice. One particle, the Ω^- hyperon, was missing but its properties were predicted, charge: neg, isosingulet, spin: $\frac{3}{2}$, strangeness: −3, mass: 1685 Mev. P. Shutt and 33 coworkers at BNL carried out experiments with a 5 Bev K^- particle beam by bombarding a W target with accelerated protons. Analysis of about 100,000 pictures taken of the interaction events in the H bubble chamber revealed in one picture the existence of a hyperon (Ω^-), with a mass of (1686 ± 12) Mev and a life of about 0.7×10^{-10} sec. The agreement between theory and experimental data is remarkable. (TTT)

3041 RADIATION CORRECTIONS FOR e-p SCATTERING. A. Bartl and P. Urban (Universität. Graz). Fortschr. Physik, 12: 386-407(1964). (In German)

The complex of infrared singularities in electron–proton scattering processes was treated using an approximation of the Eriksson method. Some studies in which radiation corrections were calculated for specific experimental setups were reviewed. The dominating significance of the infrared divergences was shown. The significance of supplementary contributions were discussed. (tr-auth)

3042 BALLOON OBSERVATIONS OF X RAYS IN THE AURORAL ZONE. 3. HIGH TIME RESOLUTION STUDIES. K. A. Anderson and D. W. Milton (Univ. of California, Berkeley). J. Geophys. Res., 69: 4457-79(Nov. 1, 1964).

During three separate balloon flights made in the auroral zone, it was found that the precipitation of energetic electrons occurred by means of short, impulsive bursts having definite features. Since these bursts were found to have no substructure, they were called microbursts. They are homogeneous with respect to rise time and duration; the decay time is less consistent. Periodic studies of microburst spacings have revealed no strong period, but a departure from purely random behavior can be shown. Some of the characteristic times of microbursts can be explained on the basis of electron motions on the auroral zone line of force. (auth)

3043 FUNDAMENTALS OF VERY LOW FREQUENCY EMISSION GENERATION MECHANISMS. N. Brice (Stanford Univ., Calif.). J. Geophys. Res., 69: 4515-22(Nov. 1, 1964).

The transfer of energy between whistler-mode signals and energetic charged particles is investigated. Resonance conditions are derived, leading to a classification of the mechanisms previously suggested for the generation of v-l-f emissions. The relation between the change in energy and the change in pitch angle of the particles is derived for the transverse resonance interaction with longitudinal whistler-mode waves. Features of the transverse resonance plasma instabilities and the anomalous Doppler effect are clarified. (auth)

3044 ELECTROMAGNETIC MASS DIFFERENCES IN THE UNITARY SYMMETRY MODEL. Susumu Okubo (Univ. of Rochester, N. Y.). J. Phys. Soc. Japan, 19: 1507-11 (Sept. 1964). (UR-875-26)

Higher-order effects due to both the electromagnetic and the SU(3)-violating interactions were investigated for masses of particles belonging to the octet and decouplet representations of the unitary symmetry. (auth)

3045 THREE-BODY PROBLEM AND A MODEL OF BARYONS. Hirotaka Sugawara (Tokyo Univ.). J. Phys. Soc. Japan, 19: 1511-13(Sept. 1964).

Relations among the masses of the SU_3 multiplets are derived assuming the existence of the "quarks" of Gell-Mann. (auth)

3046 UNITARY SYMMETRY AND REGGE POLES. Yu. M. Malyuta (Inst. of Physics, Kiev). Nucl. Phys., 61: 472-8(Jan. 1965).

A unitary symmetry model of composite baryons and mesons is proposed. The method of summation of asy[illegible]totic contributions from Cutkosky diagrams is used fo calculating the Regge trajectories of composite particles. (auth)

3047 AN ANALYSIS OF THE HIGH-ENERGY π^--p, π^+-p, K^+-p AND $\bar{p}$-p ELASTIC SCATTERING DATA. A. Frenkel, S. Krasznovszky, and G. Pintér (Central Research Inst. for Physics, Budapest). Nucl. Phys., 61: 493-6(Jan. 1965).

Data were examined for π^--p, π^+-p, K^+-p, and $\bar{p}$-p elastic scattering in the energy region between 7 and 17 Bev/c using the exact expression for the one-Regge pole contribution to the scattering amplitude published by A. Read, et al. It is concluded that the one-Regge pole approximation is definitely inconsistent with the experimental data. (auth)

3048 STUDY OF THE INTERACTION BETWEEN π MESONS AND NUCLEONS BY ONE MESON EXCHANGE. R. Laverrière (Institut de Physique Nucléaire, Lyon). Nucl. Phys., 61: 500-12(Jan. 1965). (In French)

Particle production in π-N interactions is studied by means of one-meson-exchange graphs. Calculations are made for an incident pion energy of 5 Bev in the laboratory system. For pion production, the angular distributions obtained show that it is necessary to take into account the production of the spin $\frac{3}{2}$ isobar N^*. It is found that the ratio $\sigma(\pi + N \rightarrow N^* + n\pi)/\sigma(\pi + N \rightarrow N + n\pi)$ is equal to 0.7 for low multiplicities ($n \leq 8$). For associated production of hyperons, the calculation of cross section and angular distribution shows that it can be represented by one-K meson-exchange graphs. Study of momentum spectra allows us to obtain the approximative behavior of the $\sigma_{\pi\pi}$ and $\sigma_{\pi K}$ cross sections. (auth)

3049 PHENOMENOLOGICAL ANALYSIS OF EXPERIMENTAL DATA ON PION PHOTOPRODUCTION. N. F. Nelipa (Lebedev Inst. of Physics, Moscow). Nucl. Phys., 61: 689-94(Jan. 1965).

Experimental data on pion-nucleon photoproduction are analyzed with the aid of a method based on several general concepts. Both resonant and non-resonant partial photoproduction amplitudes are determined in s and p wave approximation. (auth)

3050 STATISTICAL MECHANICS OF VELOCITY-DEPENDENT POTENTIALS. Robert M. May (Univ. of Sydney). Nucl. Phys., 62: 177-87(Feb. 1965).

The statistical mechanics of a system in which the particles interact through a velocity-dependent potential, of the form $p_{ij}V(|r_{ij}|) \cdot p_{ij}$ (p_{ij} is the relative momentum of the ith and jth particles) are considered. The aim of the investigation is to gain further understanding of the formal relation between velocity-dependent potentials and hard-core potentials in an explicitly many-body context. In the limit of classical statistics, it is found that the above interaction is indistinguishable from a hard-sphere potential; in particular the specific heat is just that for an ideal gas, a property which for velocity-independent potentials is specific to the hard-sphere case. In the limit of quantum statistics, the two potentials (velocity-dependent and hard-sphere) are no longer equivalent; it is not clear whether addition of a static potential to the velocity-dependent one could restore the exact equivalence. (auth)

3051 VALIDITY OF MANY-BODY APPROXIMATION METHODS FOR A SOLVABLE MODEL. I. EXACT SOLUTIONS AND PERTURBATION THEORY. H. J. Lipkin (Weizmann Inst. of Science, Rehovoth, Israel), N. Meshkov, and A. J. Glick. Nucl. Phys., 62: 188-98(Feb. 1965).

In order to test the validity of various techniques and formalisms developed for treating many-particle systems, a model is constructed which is simple enough to be solved exactly in some cases, but yet is non-trivial. The construction of such models is based on the observation that bilinear products of creation and annihilation operators can be considered as generators of Lie groups. Thus the problem of finding eigenvalues can be greatly simplified by the additional integrals of the motion which are present if the hamiltonian is constructed so as to commute with invariants of the group. In the present case, the model consists of N fermions distributed in two N-fold degenerate levels and interacting via a monopole-monopole force. It

is shown that the model hamiltonian is easily expressed in terms of quasi-spin operators and exact eigenvalues are obtained. In addition, eigenvalues are calculated with ordinary perturbation theory using values for the number of particles and interaction strength which are appropriate to the more realistic problems of finite nuclei. (auth)

3052 VALIDITY OF MANY-BODY APPROXIMATION METHODS FOR A SOLVABLE MODEL. II. LINEARIZATION PROCEDURES. N. Meshkov (Weizmann Inst. of Science, Rehovoth, Israel and Univ. of Maryland, College Park), A. J. Glick, and H. J. Lipkin. Nucl. Phys., 62: 199-210(Feb. 1965).

The validity of methods used in the study of many-particle systems is investigated by using the same approximation in treating a simple model for which exact solutions are available. The model consists of N fermions distributed in two N-fold degenerate levels and interacting via a monopole-monopole force. The excitation energy of the first collective state above the ground state is calculated using the following methods: the method of linearized equations of motion, linearization with the inclusion of renormalized single-particle energies, a new self-consistent linearization method. The results of these approximation methods are then compared with exact results and with the results of ordinary perturbation theory found previously. It is found that renormalization of the single-particle energies leads to a considerable improvement of the results over that obtained with the ordinary linearization method, especially for small numbers of particles. Further improvement is obtained with the self-consistent linearization method. The possibility of applying the latter method to more realistic problems is briefly discussed. (auth)

3053 VALIDITY OF MANY-BODY APPROXIMATION METHODS FOR A SOLVABLE MODEL. III. DIAGRAM SUMMATIONS. A. J. Glick (Univ. of Maryland, College Park), H. J. Lipkin, and N. Meshkov. Nucl. Phys., 62: 211-24(Feb. 1965).

The model N-fermion system is reconsidered in order to investigate the range of validity of diagrammatic many-body perturbation theory and various selective summations of higher order graphs. The familiar random phase approximation or bubble graph sum is shown to be the first term in an expansion in powers of 1/N for which the coefficients are arbitrary functions of NV/ϵ, where V is the interaction strength and ϵ is the level separation of the non-interacting system. However, the 1/N expansion converges very slowly (if at all) for $N < 40$. Other corrections to the bubble sum which do not fit into such an expansion are shown to be much more important than the 1/N corrections for small N. These are the exchange and self-energy graphs which correct for counting errors and violations of the exclusion principle when enumerating the states that a given particle can occupy. With these terms a rather good approximation to the excitation energy can be obtained, though the results are not quite as good as that obtained with fourth-order perturbation theory for small N, or for the whole range of N with the self-consistent linearization procedure described previously. (auth)

3054 AZIMUTHAL VARIATION OF COMPTON SCATTERING OF POLARIZED GAMMA RAYS. M. Singh, S. Anand, and B. S. Sood (Punjabi Univ., Patiala, India). Nucl. Phys., 62: 267-72(Feb. 1965).

The azimuthal variation of the Compton scattering of 280, 662, and 1250 kev gamma rays that are partially polarized by a previous Compton scattering through 64, 90, and 120°, respectively, was investigated. The experimental results are found to show good agreement with the predictions of Klein-Nishina formula. (auth)

3055 ON THE ANGULAR DISTRIBUTION OF SECONDARY PARTICLES IN HIGH ENERGY JETS. K. Zalewski (Inst. of Physical Chemistry, Krakow). Nukleonika, 9: 249-52(1964).

A method for analyzing the experimental angular distributions of secondary particles in high-energy jets is described. (D.C.W.)

3056 JETS PRODUCED IN LEAD-EMULSION SANDWICH STACK. J. Babecki, R. Holyński, S. Krzywdziński, A. Peeva, K. Rybicki, and W. Wolter (Inst. of Nuclear Research, Krakow). Nukleonika, 9: 271-5(1964).

Electromagnetic cascades were identified in a lead-emulsion stack exposed at about 100,000 ft. The angular distributions of particles from primary and secondary jets were measured, together with the energy of electromagnetic cascades for primary jets. The energy was also calculated from the lateral development of the cascade using Nishimura-Kamata curves. Secondary production in primary interactions in lead was also studied. (D.C.W.)

3057 ON ANOMALOUS SINGULARITIES IN PION-DEUTERON SCATTERING. K. J. Biebl (Forschungsstelle fur Physik Hoher Energien, Deutsche Akademie der Wissenschaften, Berlin). Nukleonika, 9: 397-402(1964).

The singularities of the $\pi + d \rightarrow n + n$ amplitude and the elastic $\pi - d$ amplitude were investigated in a dispersion theoretic approach. (D.C.W.)

3058 A MODIFICATION OF S-MATRIX REDUCTION FORMULAS AND ITS ANALYTICAL CONSEQUENCES. K. Kaschluhn and E. Wieczorek (Humboldt Universität, Berlin and Forschungsstelle fur Physik Hoher Energien, Deutsche Akademie der Wissenschaften, Berlin). Nukleonika, 9: 403-6(1964).

The derivation and analytic consequences of a modified s-matrix reduction formula are discussed. (D.C.W.)

3059 ENERGY VS LONGITUDINAL MOMENTUM PLOT FOR TWO BODY PROCESSES. T. Coghen (Inst. of Nuclear Research, Krakow). Nukleonika, 9: 407-8(1964).

An energy vs longitudinal momentum plot for particles from a two-body decay is described, and its uses in the study of two-body decay processes are indicated. (D.C.W.)

3060 ELECTROMAGNETIC MASS DIFFERENCES OF BARYONS AND MESONS. J. H. Wojtaszek, R. E. Marshak, and Riazuddin (Univ. of Rochester, N. Y.). Phys. Rev., 136: B1053-63(Nov. 23, 1964). (UR-875-46)

The four independent baryonic and two mesonic electromagnetic (E.M.) mass differences are evaluated on the basis of the unitary symmetry model. An approximation scheme is devised, and its relation to a dispersion-theoretic treatment by Cottingham is pointed out. Four contributions to the E.M. mass differences are taken into account: the elastic form-factor part, processes which involve the two isovector transitions $(\pi^0 - \eta)$ and $(\Sigma^0 - \Lambda)$, and the self-induced mass differences. Unitary symmetry is used to provide values for quantities not given by experiments, form factors for strange particles and coupling constants. A previous result for the pion mass difference is confirmed because it is shown that the chief contribution is due to the elastic form-factor part. All the observed baryonic mass differences can be approximately reproduced. The sign of the kaon mass difference can be explained, but the quantitative predictions for the kaon are still unreliable. (auth)

3061 SU(3) SYMMETRY AND THE NONLEPTONIC K-MESON PROCESSES. S. Oneda, Y. S. Kim, and D. Korff (Univ. of Maryland, College Park). Phys. Rev., 136: B1064-73(Nov. 23, 1964).

The consequences of the SU(3) octet scheme for the nonleptonic weak interactions are studied in some of the nonleptonic K-meson processes. The $K_1^0 - K_2^0$ mass difference and the rates of $K_2^0 \rightarrow 2\gamma$ and $K_2^0 \rightarrow \pi^+ + \pi^- + \gamma$ decays are discussed. The effect of $\omega - \varphi$ mixing is considered in the $K_2^0 \rightarrow 2\gamma$ decay. The possible violation of the $|\Delta I| = \frac{1}{2}$ rule in the $K_2^0 \rightarrow 3\pi$ decay is discussed in terms of the meson (η) pole contribution. The characteristic features of $K^+ \rightarrow \pi^+ + \pi^0 + \gamma$ and $K^+ \rightarrow 3\pi$ decays in the model are also discussed. It is inferred that the rate of $K^+ \rightarrow \pi^+ + \pi^0 + \gamma$ decay is dominated by the internal bremsstrahlung contribution. A possible effect of a unitary singlet pseudoscalar meson on these problems is also discussed. (auth)

3062 MEASUREMENT OF THE LIFETIMES OF THE Λ^0 HYPERON AND K_1^0 MESON. M. N. Kreisler, O. E. Overseth, and J. W. Cronin (Princeton Univ., N. J.). Phys. Rev., 136: B1074-6(Nov. 23, 1964).

The lifetimes of the hyperon (Λ^0) and the meson (K_1^0) were measured in a spark-chamber experiment. With 2260 events, the hyperon (Λ^0) lifetime was found to be 2.31 ±

0.10×10^{-10} sec. The meson (K_1^0) lifetime was measured to be $0.86 \pm 0.04 \times 10^{-10}$ sec with 545 events. (auth)

3063 ORIGIN OF UNITARY SYMMETRY AND CHARGE CONSERVATION IN STRONG INTERACTIONS. E. C. G. Sudarshan (Brandeis Univ., Waltham, Mass), L. O'Raifeartaigh, and T. S. Santhanam. Phys. Rev., 136: B1092-6(Nov. 23, 1964).

The relation of the existence of multiplets of strongly interacting particles and the possible unitary symmetry of their interactions is discussed. A dynamical principle is presented concerning the one-particle propagators (two-point functions), but yielding the existence of a unitary symmetry group for their trilinear interactions. Electric charge (and hypercharge) conservation in the interaction of these particles is also provided by the principle. (auth)

3064 CHOICE BETWEEN PRIMARY AND DYNAMICAL $|\Delta T| = \frac{1}{2}$ RULE IN THE CURRENT-CURRENT PICTURE FOR NONLEPTONIC WEAK DECAYS. Jogesh C. Pati and Sadao Oneda (Univ. of Maryland, College Park). Phys. Rev., 136: B1097-1101(Nov. 23, 1964).

The p-wave intrinsic structure of $K \rightarrow 3\pi$ decays is studied in the current-current picture for nonleptonic weak interactions, and it is shown that an accurate measurement of the asymmetry parameters of $K \rightarrow 3\pi$ decays could distinguish whether the $|\Delta T| = \frac{1}{2}$ rule is primary of dynamical. Some comments are made concerning the general necessity of enhancement of nonleptonic modes regardless of whether the $|\Delta T| = \frac{1}{2}$ rule is primary or dynamical. (auth)

3065 1^- ASSIGNMENT FOR THE B MESON. Sharashchandra H. Patil (Univ. of California, San Diego, La Jolla). Phys. Rev., 136: B1102-11(Nov. 23, 1964).

The $\pi\pi$, $\pi\omega$ scattering amplitudes in the I = J = 1 state are parameterized in terms of five parameters which are determined so as to give the meson (ρ) position and width, the ω width, and the meson (B) position and its $\pi\omega$ decay width under the assumption that B has quantum numbers 1^-. These amplitudes are then used to discuss $\pi\pi$,$\pi\omega$ production processes in terms of a simple peripheral model including π,ω exchanges. The model predicts a large $\pi^+\pi^-$ decay rate of B, with a cross section comparable to the experimental $\pi^+\pi^-$ resonant cross section (the f^0) observed at approximately the same position as the B meson. On the other hand, since the B is an I = 1 particle, this implies that the branching ratio of the $2\pi^0$ decay to that of the $\pi^+\pi^-$ decay should be small. This is incompatible with the experimentally observed large branching ratio. Within the limitations of the model, it is therefore unlikely that the B meson is a 1^- particle. (auth)

3066 SELF-ENERGY OF THE ELECTRON. K. Johnson (Massachusetts Inst. of Tech., Cambridge), M. Baker, and R. Willey. Phys. Rev., 136: B1111-19(Nov. 23, 1964). (TID-21136)

A perturbation theory is developed within the usual formalism of quantum electrodynamics which yields a finite unrenormalized electron Green's function and a finite value for the electron's electromagnetic self-mass in each order. This is subject only to the qualification that the vacuum polarization is also obtained without divergences. Furthermore, the bare mass of the electron must vanish; the electron mass must be totally dynamical in origin. (auth)

3067 APPLICATION OF N/D AND DETERMINANTAL METHODS TO YUKAWA POTENTIAL SCATTERING. Max Luming (Univ. of California, San Diego, La Jolla). Phys. Rev., 136: B1120-33(Nov. 23, 1964).

The s-, p-, and d-wave amplitudes for the Yukawa potential are found by the N/D method. The solution with the first and second Born cuts gives a reasonable approximation to the exact amplitude in the low-energy region for potential strengths up to values strong enough to give an s-wave bound state. The solution yields a fair prediction of the s-wave binding energy. The first- and second-order determinantal solutions are also obtained. Because of the distortion of the left-hand cut, the determinantal method gives less reliable results than the N/D method. (auth)

3068 DYNAMICAL EVIDENCE THAT REGGE POLES CONTROL SMALL-MOMENTUM-TRANSFER SCATTERING AT HIGH ENERGY. Geoffrey F. Chew and Vigdor L. Teplitz (Univ. of California, Berkeley). Phys. Rev., 136: B1154-7(Nov. 23, 1964). (UCRL-11495(Rev.))

Assuming that Regge poles control high-energy scattering at small momentum transfers, a dynamical prediction is made for the magnitude of the total π-π cross section, and an estimate is given for the corresponding width of the forward diffraction peak, starting from a knowledge of the ρ and f^0 masses and the lifetime of the ρ. The results are in satisfactory agreement with values derived from high-energy π-N and N-N scattering through the factorization theorem for residues. (auth)

3069 A SEARCH FOR CHARGE $\frac{1}{3}e$ PARTICLES IN COSMIC RAYS. A. W. Sunyar, A. Z. Schwarzschild, and P. I. Connors (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 136: B1157-9(Nov. 23, 1964). (BNL-8191)

A search was conducted for particles of charge $\frac{1}{3}e$ (quarks) in cosmic rays at sea level. No such particles were found. The experiment yields an upper limit for the frequency of high-energy quarks of 1 per 2×10^5 relativistic mesons (μ). This limit is related to a limit on the quark production cross section as a function of possible quark mass. Macroscopic experiments which might have detected quarks in matter are briefly discussed. (auth)

3070 FURTHER ANALYSIS OF THE DECAY $\pi \rightarrow e + \nu + \gamma$. Stanley G. Brown and Sidney A. Bludman (Univ. of Pennsylvania, Philadelphia). Phys. Rev., 136: B1160-3 (Nov. 23, 1964).

The structure-dependent part of the decay $\pi \rightarrow e + \nu + \gamma$ was recalculated, using the conserved vector current hypothesis, in order to derive information on the axial-vector-current form factor. Previous calculations of Bludman and Young were extended by including, as a phenomenological parameter, the axial-vector contribution relative to polar-vector, and by calculating integrals of the decay rate over various portions of phase space likely to be measured. The experiments can be analyzed in terms of the $\pi\rho$ coupling to the axial-vector current. It is concluded that the recent experiments of Depommier establish the presence of such axial-vector structure contributing to the decay, but that this component can not be assigned to a weak-interacting vector meson rather than to strong-interaction structure. (auth)

3071 NEUTRINO OPACITY. I. NEUTRINO-LEPTON SCATTERING. John N. Bahcall (California Inst. of Tech., Pasadena). Phys. Rev., 136: B1164-71(Nov. 23, 1964).

The contribution of neutrino-lepton scattering to the total neutrino opacity of matter is investigated. It is found that, contrary to previous beliefs, neutrino scattering dominates the neutrino opacity for many astrophysically important conditions. The rates for neutrino-electron scattering and antineutrino-electron scattering are given for a variety of conditions, including both degenerate and nondegenerate gases; the rates for some related reactions are also presented. Formulas are given for the mean scattering angle and the mean energy loss in neutrino and antineutrino scattering. Applications are made to the following problems: the detection of solar neutrinos; the escape of neutrinos from stars; neutrino scattering in cosmology; and energy deposition in supernova explosions. (auth)

3072 BACKWARD SCATTERING IN π-p COLLISIONS AT 3.15 AND 4 Bev/c. Shigeo Minami (Louisiana State Univ., Baton Rouge). Phys. Rev., 136: B1171-3(Nov. 23, 1964).

On the basis of an analysis of the experimental data for forward scattering, both the upper limit and the lower limit of $d\sigma/dt$ for backward scattering are predicted. The experimental values of $d\sigma/dt$ in the backward direction lie within the region defined by two curves corresponding to the upper and lower limits of $d\sigma/dt$. (auth)

3073 CHARGED-PION PHOTOPRODUCTION FROM DEUTERIUM WITH POLARIZED BREMSSTRAHLUNG. F. F. Liu, D. J. Drickey, and R. F. Mozley (Stanford Univ., Calif.). Phys. Rev., 136: B1183-6(Nov. 23, 1964).

Measurements were made on the ratio of pion-production cross sections at right angles to and along the photon electric-field vector. The positive and negative pions were

first momentum-analyzed and counted by means of a counter telescope. Data were taken at 45, 90, and 135° in the center-of-mass system and at proton energies of 225, 330, and 450 Mev. The data are compared with the dispersion-relation calculation of McKinley. (auth)

3074 POLARIZATION OF RECOIL PROTONS IN π^+p ELASTIC SCATTERING AT 864, 981, AND 1301 Mev. Richard D. Eandi, Thomas J. Devlin, Robert W. Kenney, Paul G. McManigal, and Burton J. Moyer (Univ. of California, Berkeley). Phys. Rev., 136: B1187-9(Nov. 23, 1964).

The angular distributions of recoil-proton polarization in elastic π^+p scattering were measured at 864, 981, and 1301 Mev. Polarization measurements were made by observing the azimuthal asymmetry in the subsequent scattering of recoil protons in large carbon-plate spark chambers. The spark chambers proved to be very suitable polarization analyzer detectors. Strong variation of the polarization with backward pion scattering angle was observed. (auth)

3075 MODEL FOR LEPTONIC INTERACTIONS. Christian Fronsdal (Univ. of California, Los Angeles). Phys. Rev., 136: B1190-6(Nov. 23, 1964).

A theory of weak interactions, based on the Kemmer-Yukawa coupling of a scalar charged boson to the weak current, is consistent with all known facts. The mathematical consistency of the theory is studied, and it is found that the divergences of low-order perturbation amplitudes are much less serious than anticipated. Thus, electromagnetic corrections of order $e^2(G)^{\frac{1}{2}}$ to the amplitude for weak photoproduction of the boson, weak corrections of order eG to the magnetic moment of fermions, and weak corrections of order e^2G to Compton scattering from charged fermions are all finite. (auth)

3076 INELASTIC EFFECTS OF THE N* AND ρ ON PION-NUCLEON SCATTERING. F. T. Meiere (Massachusetts Inst. of Tech., Cambridge). Phys. Rev., 136: B1196-1206(Nov. 23, 1964). (MIT-2098-46)

A formalism for calculating the π-N scattering amplitude including the inelastic production of a (3,3) isobar is developed and extended to include meson (ρ) production. The exact unitarity relations are found to contain nondiagonal terms which, when simplified, are interpreted as the overlap between resonances. Calculations based on the N/D method are performed in which the unphysical discontinuities are evaluated from single-nucleon or pion-exchange diagrams. The numerical solution of the resulting integral equations is compared to simpler approximations and to experiments. The importance of both the isobar and the meson (ρ) is pointed out. For the $D_{\frac{3}{2}}$ channel, a resonance is found for $T = \frac{1}{2}$, but not for $T = \frac{3}{2}$. No resonance is found for either of the $F_{\frac{5}{2}}$ or $D_{\frac{5}{2}}$ channels. (auth)

3077 INTERFERENCE EFFECTS IN MULTIMESON RESONANCES. William R. Frazer, José R. Fulco, and Francis R. Halpern. Phys. Rev., 136: B1207-16(Nov. 23, 1964).

The problem of interference effects in cascade decays of multimeson resonances—decays of the form $X \rightarrow Y + (n$ mesons) followed by $Y \rightarrow (m$ mesons)—is discussed. The specific case $A^+ \rightarrow \pi^+ + \rho^0$ is discussed in detail, and results are presented for the decay $B^+ \rightarrow \pi^+ + \omega$. The effect of experimental resolution is evaluated. (D.C.W.)

3078 AMPLITUDE BOUND IN LADDER GRAPH MODELS. [PART] II. George Tiktopoulos and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev., 136: B1217-20(Nov. 23, 1964).

A procedure described previously for bounding ladder-graph scattering amplitudes is applied to two models: exchange of pairs of scalar particles (bubbles) and exchange of vector particles. The forward-scattering absorptive amplitudes are bounded from above. Apart from logarithmic factors, the correct amplitudes are known to grow with energy as S^{α}; and the present results determine upper bounds on the exponents α. For the case in which the exchanged particles are massless, the upper bounds in fact coincide with the exact results for α as given in the literature. (auth)

3079 MEASUREMENT OF THE TRIPLE SCATTERING PARAMETER R' AT 213 Mev. Kazuo Gotow and Frederick Lobkowicz (Univ. of Rochester, N. Y.). Phys. Rev., 136: B1345-7(Dec. 7, 1964). (UR-875-48)

In a continuation of the study of the N-N interaction, a combination of the triple scattering parameters R and R' in p-p scattering at 213 Mev was measured in the angular range from 30 to 90° in the center-of-mass. By using an earlier measurement of R, values of R' were obtained. The data are compared to predictions given by the Hamada-Johnston potential model and by a modified phase-shift analysis using all previously measured data. (auth)

3080 EMPIRICAL MASS RELATIONS INVOLVING THE STRONGLY INTERACTING PARTICLES. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 136: B1364-81(Dec. 7, 1964). (BNL-8363)

A set of mass relations which connect the masses of the strongly interacting particles is presented. All of the observed particle masses can be represented with good accuracy by a simple additive relation, in which there enter only two fundamental constants. Many examples of the relation $m_3 = m_1 + m_2$ were obtained, where m_1, m_2, and m_3 are the masses of three strongly interacting particles. It is shown that there exist many cases of particle pairs having the same mass difference $m_1 - m_2 = m_3 - m_4$. Moreover, there are about 20 sequences of particles, where a sequence is defined as a group of three or more particles with the same mass spacing. A set of simple mass relations has been obtained for the meson (K) and the K*(725) and K*(888) resonances. The relation of the mass of the meson (μ) to the mass spectrum of the strongly interacting particles was investigated. Finally, for a large number of particle pairs (a,b), the relation $m_a = \lambda m_b$ is obtained, where λ is a simple fraction. (auth)

3081 HIGHER BARYON RESONANCES IN THE STATIC MODEL. E. S. Abers, L. A. P. Balazs, and Y. Hara (California Inst. of Tech., Pasadena). Phys. Rev., 136: B1382-8(Dec. 7, 1964).

The N/D solution to the static model, with linear approximation to the D function, is applied to a sequence of meson-baryon scattering problems. As in the old strong-coupling model, it is found that the N and Δ are the first two members of a sequence of particles with $I = J = \frac{1}{2}, \frac{3}{2}, \frac{5}{2}, \frac{7}{2}, \ldots$, and that an analogous sequence is obtained when strange particles and SU(3) symmetry are included. In both cases, the $J = \frac{5}{2}$ particle is discussed in some detail. In the SU(2) case, general expressions are also derived for the widths of all the other members of the sequence. (auth)

3082 IMPACT-PARAMETER K-MATRIX APPROACH TO HIGH-ENERGY PERIPHERAL INTERACTIONS. Richard C. Arnold (Univ. of California, Los Angeles). Phys. Rev., 136: B1388-98(Dec. 7, 1964).

An approximate dispersion-theoretic treatment of peripheral inelastic processes is introduced using a K-matrix formalism based on the impact-parameter representation of Blankenbecler and Goldberger. The method allows the use of one-meson exchange poles as a framework for constructing a multichannel scattering amplitude which satisfies unitarity in the high-energy region, allowing for an indefinitely large number of open channels. The reaction matrix is time-reversal symmetric and exhibits any other symmetries of the pole terms. Applications are numerically worked out for models of high-energy $\bar{K}$-p and n-p charge exchange, and in the former case satisfactory agreement with experiments is achieved. A qualitative discussion is given of peripheral isobar production models. The high-energy $\bar{p}$-p and $\bar{K}$-p diffraction scattering is examined, as well as the agreement of the small-momentum-transfer behavior with a simple model not involving Regge poles. The method sheds no light on the difference between $\bar{p}$-p and p-p scattering at high energies. (auth)

3083 NUCLEON-NUCLEON SCATTERING WITH INELASTIC UNITARITY. Philip W. Coulter (Stanford Univ., Calif.), Antonio Scotti, and Gordon L. Shaw. Phys. Rev., 136: B1399-1404(Dec. 7, 1964).

The effects of inelastic unitarity on dynamical calculation of N-N scattering are studied, using the N/D formal-

ism for partial-wave amplitudes modified to take into account reaction channels by means of the inelastic factor η. The equations are solved for the $^1D_2$ amplitude for which the inelastic scattering is known (for laboratory kinetic energies $E_L \lesssim 800$ Mev) and large. Left-hand-cut Born terms determined by Scotti and Wong are used. The calculated (real part of the) phase shift agrees very closely with the Scotti-Wong results for $E_L \lesssim 200$ (for reasonable choices of the high-energy behavior of η) but deviates appreciably at higher energy, peaking at ≈400–500 Mev and going negative at ≳1 Bev. (auth)

3084 BRANCHING RATIOS OF THE K^+ MESON. Francis S. Shaklee, Gary L. Jensen, Byron P. Roe, and Daniel Sinclair (Univ. of Michigan, Ann Arbor). Phys. Rev., 136: B1423-31(Dec. 7, 1964).

The stopping of mesons (K^+) was observed in a xenon bubble chamber. The branching ratios of the $K_{\mu 2}$, $K_{\mu 3}$, K_{e3}, $K_{\tau 2}$, τ, and τ' decay modes were calculated, giving, in percent, 63.0 ± 0.8, 3.0 ± 0.5, 4.7 ± 0.3, 22.4 ± 0.8, 5.1 ± 0.2, and 1.8 ± 0.2, respectively. These ratios are compared both with previous experiments and with some theoretical predictions. The ratio of the three-body pionic decay modes is consistent with the $\Delta T = \frac{1}{2}$ rule; and the ratio of the three-body leptonic-decay modes is consistent with $f_-/f_+ = 0$. The $K_{\mu 2}$ branching ratio does not contradict a recent theory of universality in the two-body leptonic decays of the π and K mesons. (auth)

3085 STUDY OF THE THREE-BODY LEPTONIC DECAY MODES OF THE K^+ MESON. Gary L. Jensen, Francis S. Shaklee, Byron P. Roe, and Daniel Sinclair (Univ. of Michigan, Ann Arbor). Phys. Rev., 136: B1431-8(Dec. 7, 1964).

The K^+_{e3} and $K^+_{\mu 3}$ decay spectra were studied. The results strongly favor vector coupling even if the form factors are allowed arbitrary energy dependence. The relative amplitudes of scalar and tensor couplings are less than 0.3 with the most probable value around 0. The muon and electron couplings are found to be the same within the 14% error quoted. All energy dependences of the form factors are found to be small. (auth)

3086 MEASUREMENTS OF THE RATES OF THE DECAY $\pi^+ \rightarrow \pi^0 + e^+ + \nu$ AND OF π^- CAPTURE IN LiH, CH_2, AND CH. D. Bartlett, S. Devons, S. L. Meyer, and J. L. Rosen (Columbia Univ., New York). Phys. Rev., 136: B1452-63(Dec. 7, 1964).

The branching ratio for $\pi^+ \rightarrow \pi^0 + e^+ + \nu$ was measured using the near anticollinearity of the two γ rays from the subsequent decay of the meson (π^0). On the basis of 39 events, of which 3 are attributed to background, and an independent calibration of the overall efficiency of the apparatus, the branching ratio was determined to be $(0.97 \pm 0.020) \times 10^{-8}$, in agreement with previous measurements and the prediction of the conserved-vector-current hypothesis. Using the same apparatus, W, the fraction of stopped mesons (π^-) captured by hydrogen nuclei bound in chemical compounds was measured with the following results: $W_{LiH} = 40 \pm 4 \times 10^{-3}$, $W_{CH_2} = 17.9 \pm 1.9 \times 10^{-3}$; and $W_{CH} = 5.5 \pm 0.7 \times 10^{-3}$. Meson ($\pi^-$) capture in H_2-N_2 and H_2-He gas mixtures was also briefly studied. (auth)

3087 DETERMINATION OF THE τ^+ BRANCHING RATIO. Andrew Callahan, Robert March, and Robert Stark (Univ. of Wisconsin, Madison). Phys. Rev., 136: B1463-4(Dec. 7, 1964). (TID-20839)

The branching ratio for the τ^+ decay mode ($K^+ \rightarrow \pi^+\pi^+\pi^-$) was obtained from 2332 τ^+ decays in a bubble chamber containing C_3F_8. It was found that 5.54 ± 0.12% of all mesons (K^+) decay by this mode. Combining this result with four previous measurements gives a weighted "world mean" of 5.46 ± 0.09%. (auth)

3088 POSITIVE PHOTOPION PRODUCTION FROM HYDROGEN NEAR THRESHOLD. Donald A. McPherson, Duane C. Gates, Robert W. Kenney, and William P. Swanson (Univ. of California, Berkeley). Phys. Rev., 136: B1465-71(Dec. 7, 1964). (UCRL-11525)

The differential cross sections for photopion production from protons were measured for photon energies from 154 to 185 Mev, using the Alvarez 4-in. liquid-hydrogen bubble chamber in the bremsstrahlung beam of the Berkeley electron synchrotron. The results are in excellent agreement with the theoretical calculations by Ball, who applied the Mandelstam representation to the process. Also a value of $\Lambda = (+0.931 \pm 0.59)$ e was obtained, where Λ is the multiplicative factor associated with the matrix element for photopion production from pions as calculated by Wong. (auth)

3089 LIFETIME AND DECAY OF UNSTABLE PARTICLES IN S-MATRIX THEORY. M. L. Goldberger (Princeton Univ., N. J.) and K. M. Watson. Phys. Rev., 136: B1472-80(Dec. 7, 1964).

The possible time dependence of decay laws for unstable particles is investigated. The probability P(t) that an unstable particle has not decayed at time t is expressed in terms of S-matrix quantities. It is concluded that, contrary to popular belief, the exponential decay law $P = e^{-\Gamma t}$ is only one of a discrete set of possible decay laws. (auth)

3090 ANALYSIS OF LOW-ENERGY K^+-p ELASTIC SCATTERING. A. D. Martin (Univ. of Durham, Eng.) and T. D. Spearman. Phys. Rev., 136: B1480-92(Dec. 7, 1964).

An analysis based on dispersion-relation techniques is applied to experimental data for K^+-p elastic scattering. Particular reference is made to the "force of longest range" due to the exchange of low-mass pion pairs with isospin I = 0. The effect of this exchange force is calculated in terms of only one unknown parameter λ which may essentially be chosen to be a linear combination of the K-π scattering lengths. The other forces of shorter range are described by further undetermined parameters. The K^+-p differential cross section is calculated in terms of these parameters, and a minimization procedure is used to obtain a fit to the experimental data. A good fit is obtained for a well-defined set of values of the parameters. In particular, λ is well determined. A sum rule for K-π scattering is used to calculate a further relation between the K-π scattering lengths so that the value of each of these is obtained. (auth)

3091 PION EXCHANGE CURRENTS IN DEUTERON PHOTODISINTEGRATION. DISPERSION THEORY. Malcolm H. Skolnick (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev., 136: B1493-1514(Dec. 7, 1964).

A dispersion-theoretic treatment of the amplitudes describing photomagnetic disintegration of the deuteron at energies very near threshold was developed. The effects of meson exchange currents in the photodisintegration or equivalent n-p capture process are calculated. At threshold the photomagnetic transition is dominant. This transition is essentially the isovector $^3S_0 \rightarrow {}^1S_0$ transition. A fixed-angle dispersion relation for the dipole amplitude describing this transition can be written in terms of the related covariant amplitudes. Solutions to the dispersion relation are found using several different approximations. (auth)

3092 CROSSING RELATIONS AND THE PREDICTION OF SYMMETRIES IN A SOLUBLE MODEL. A. W. Martin and W. D. McGlinn (Argonne National Lab., Ill.). Phys. Rev., 136: B1515-22(Dec. 7, 1964).

The two-channel static model, incorporating unitarity and a nontrivial crossing relation, is known to be exactly soluble for a specific choice of the crossing matrix. The solution is largely independent of a number of the dynamical assumptions of the static model and may, therefore, indicate properties of more realistic models for the strong interactions. The two-channel problem is generalized by introducing arbitrary crossing matrices of a type suitable to the static model. It is shown that the requirement that exact solutions exist does not lead to restrictions upon the crossing matrices and hence to the prediction of symmetries. Solutions are exhibited for all values of the parameterized crossing matrix. However, special solutions of a particularly simple form exist only for crossing matrices corresponding to the symmetry group SU(2). The relation between these special solutions and the general solution is discussed. (auth)

3093 LEPTONIC DECAY OF HYPERONS IN AN INTERMEDIATE-BOSON THEORY. Seitaro Nakamura

(Tokyo Univ. and Nihon Univ., Tokyo) and Kunio Itami. Phys. Rev., 136: B1522-4(Dec. 7, 1964).

The energy spectrum of electrons emitted in the beta decay of hyperons is calculated on the basis of the intermediate-boson theory of Tanikawa and Watanabe. In the bare-nucleon approximation, an appreciable deviation of the spectrum shape from that calculated on the local limit of the universal Fermi interaction is expected. (auth)

3094 AN ITERATION METHOD IN THE S-MATRIX THEORY. Rudolph C. Hwa (Univ. of California, Berkeley). Phys. Rev., 136: B1525-32(Dec. 7, 1964). (UCRL-11545)

An iteration method is formulated for the determination of the partial-wave scattering amplitude on the basis of analyticity and unitarity postulates. The analytic properties in the physical and unphysical sheets are considered simultaneously in a study of the logarithmic S function ln $S_l(s)$. The usual N/D approach and some of its associated drawbacks are avoided. A relation between the total number of composite particles and the phase change of $S_l(s)$ along the left-hand cut is derived; constituting a generalization of Levinson's theorem. The use of this relation in the iteration method is discussed. (auth)

3095 REPRESENTATIONS AND MASS FORMULAS FOR SU(4). Pekka Tarjanne (Univ. of Wisconsin, Madison). Phys. Rev., 136: B1532-4(Dec. 7, 1964).

A hierarchial scheme of SU(n) symmetries among the strong interactions is proposed with the n−1 additive quantum numbers exactly conserved. Simple dynamics as well as mass-splitting considerations are shown to favor the assignment of the mesons to the 15-dimensional representations and the baryons and $\frac{3}{2}^+$ isobars to two inequivalent 20-dimensional representations of SU(4). The predictions of new particles are discussed. (auth)

3096 EVIDENCE FOR AN N* RESONANCE AT 1425 Mev. Stuart Lee Adelman (Cambridge Univ., Eng.). Phys. Rev. Letters, 13: 555-7(Nov. 2, 1964).

Evidence was found for the existence of a resonance in the meson (π)-nucleon system at an effective mass of approximately 1425 Mev. The evidence was obtained from photographs from a hydrogen bubble chamber exposed to a meson (K^-) beam at 1.455 ± 0.025 Bev/c. (C.E.S.)

3097 TOTAL CROSS SECTIONS AND ANGULAR DISTRIBUTIONS FOR π^- p CHARGE EXCHANGE IN THE SECOND AND THIRD RESONANCE REGIONS. F. Bulos (Brown Univ., Providence), R. E. Lanou, A. E. Pifer, et al. Phys. Rev. Letters, 13: 558-62(Nov. 2, 1964). (MIT-2098-59p.)

Data for nine different incident meson (π) energies were analyzed to study the cross sections and angular distributions in the reaction $\pi^- + p \rightarrow \pi^0 + n$. The energies span the region of the second (600 Mev) and third (900 Mev) meson (π)-nucleon resonances. The angular distributions indicate very little structure in the 600-Mev region, but in the 900-Mev region give strong evidence for a $D_{\frac{3}{2}} - F_{\frac{3}{2}}$ interference in the $T = \frac{1}{2}$ state. (C.E.S.)

3098 VIOLATION OF CP INVARIANCE AND THE POSSIBILITY OF VERY WEAK INTERACTIONS. L. Wolfenstein (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. Letters, 13: 562-4(Nov. 2, 1964).

The Sachs model for explaining the $K_2^0 \rightarrow 2\pi$ decay in which (1) the CP-violating terms is maximal in the sense that the $\Delta Q = -\Delta S$ decay interaction is 90° out of phase with $\Delta Q = +\Delta S$ interaction, (2) CP violation would not occur in nonleptonic decays or in leptonic decays other than that of K^0, and (3) the strength of the CP-violating term is comparable to the CP-conserving term, is considered. Possible objections to the Sachs model are raised, and an alternative is suggested which essentially satisfies conditions (1) and (2) but requires that CP-violating weak interactions are weaker than the CP-conserving ones by a factor of 10^7 to 10^8. (C.E.S.)

3099 CHARGE SYMMETRY, CHARGE INDEPENDENCE, AND THE NUCLEON-NUCLEON SCATTERING LENGTHS. Leon Heller (Los Alamos Scientific Lab., N. Mex.), Peter Signell, and N. R. Yoder. Phys. Rev. Letters, 13: 577-9(Nov. 9, 1964).

Potential model predictions for the n-n scattering length were obtained on the basis of charge symmetry. The results were in good agreement with measurements, confirming charge symmetry. Three approaches to calculating the n-p scattering length were also considered. (D.C.W.)

3100 SU(4) MASS FORMULA. R. J. Oakes (Stanford Univ., Calif.) and D. Speiser. Phys. Rev. Letters, 13: 579-81(Nov. 9, 1964).

The mass formula for an arbitrary representation of SU(4) is given, based on the assumption that the mass splittings transform like a component of the regular representation of SU(4). The usefulness of subgroups of SU(4) is also considered. (D.C.W.)

3101 PARTICLES AND PRINCIPLES. Murray Gell-Mann (California Inst. of Tech., Pasadena). Phys. Today, 17: 22-4; 26; 28(Nov. 1964).

The status of the theory of elementary particles is summarized, with emphasis on strong and weak interactions. The algebraic principles and conservation laws discovered are considered. (D.C.W.)

3102 OBSERVATIONS IN HIGH-ENERGY PHYSICS. Leon M. Lederman (Columbia Univ., New York). Phys. Today, 17: 30-2; 34; 36-9(Nov. 1964).

A brief survey of elementary particle physics is presented, emphasizing the experimental aspects. Developments in apparatus are considered, as well as specific experiments and their implications. (D.C.W.)

3103 RADIATION LENGTH AND CRITICAL ENERGY UNITS. O. I. Dovzhenko and A. A. Pomanskii. Tr. Fiz. Inst., Akad. Nauk SSSR, 26: 166-91(1964). (In Russian)

The paths of high-energy electrons and photons passing through matter and suffering energy losses primarily through bremsstrahlung and pair formation are usually expressed in radiation units of length (t-units). The average energy lost by the electrons upon ionization to a t-unit is designated as the critical energy. The cascade equations can be solved using the T-units without referring to the manner in which the electron–photon avalanches are formed. Previously noted divergences in the bremsstrahlung and pair formation of atomic electrons were more closely examined. The calculations indicated that the method for the determination of the critical energy by averaging the critical spectrum and by the method proposed by Rossi lead to practically identical results if the same radiation units of length are used. The values obtained agree quite well with previous data; only in the case of heavy elements, such as Pb, was there a divergence of about 20%. (TTT)

3104 FLUCTUATION OF PARTICLE NUMBER IN ELECTRON-PHOTON SHOWER. N. M. Gerasimova. Tr. Fiz. Inst., Akad. Nauk SSSR, 26: 192-206(1964). (In Russian)

The electron–photon showers involve some strongly fluctuating processes which may cause deviations from their average parameters; therefore, comparison of experimental data with theoretical derivations cannot yield unambiguous answers. In order to clarify this problem, a method was developed by which the probability that a particle with a given energy will form a shower with a given number of electrons at a certain depth can be determined. The method may be used for solving any physical problem involving cascade processes and for calculating the distribution processes of the particles. The probability that electrons with an energy of E_0 at a depth of t + dt will form N_e particles is related to the probability of their flying through the layer dt without interaction, forming a shower afterward and their ability of emitting a photon in the dt layer; after this event, two independent showers may be distinguished. Consideration of the ionization losses does not change markedly the over-all picture of the fluctuation of the total number of particles. (TTT)

3105 ANALYSIS OF THE ANGULAR DISTRIBUTION OF PARTICLES PRODUCED BY HIGH-ENERGY NUCLEAR INTERATIONS IN PHOTOEMULSION. G. B. Zhdanov. Tr. Fiz. Inst., Akad. Nauk SSSR, 26: 207-23(1964). (In Russian)

The law of the constancy of the transverse pulses of the newly formed particles, $p_\perp$, which postulates that $p_\perp$ is independent of the initial energy E_0 and the emission angle θ of the secondary particles, is a very useful tool in the analysis of the angular distribution of particles. The studies of the Chicago photoemulsion group (A. G. Barkow et al.) on the large energy transfer involving $X^0\pi^4$ mesons were further examined, including in the study the events measured by workers at the Physical Institute of the USSR of Sciences and other photoemulsion groups. The events were classified according to the value of $\Delta E = \overline{p}_\perp \Sigma\theta\Gamma^{-1}$, without considering the soft components. Four groups could be distinguished in the angular distribution of the high-energy (3 to 5×10^{12} ev) interactions: interactions involving a large number of colliding particles with small masses and isotropic angular distribution in the center of inertia system; interactions involving a small number of particles and a low mass of the target and an isotropic angular distribution; interactions with a small number of particles and a low mass of the target, with isotropic and asymmetric angular distribution; and interactions with a large number of particles and a target mass near that of the nucleon and with an anisotropic but symmetrical angular distribution. The properties of the isotropic and anisotropic distributions agree well with the notions concerning the formation of one or two fireballs, respectively, carrying away about 30% of the energy of each interaction. (TTT)

3106 ELIMINATION OF t-MATRIX SINGULARITIES IN NON-VANISHING TOTAL MOMENTUM. Stephan Braun (Universität, Gottingen, Ger.). Z. Naturforsch., 19a: 1034-50(Sept. 1964). (In German)

As was shown by Tomasini it is possible to develop a perturbation theory for a many-fermion system by starting with a Bogoljubov-transformed Hamiltonian having an energy gap in the unperturbed Hamiltonian. An investigation of the analog to the Brueckner ladder approximation showed this to be free of the Cooper-type divergencies of the original Brueckner t-matrix provided only zero total momentum of the pairs is taken into account. The investigation was extended to non-vanishing total momentum. For a separable potential and weak interaction it is shown that there are no divergencies for any total momentum. The reason for this (as in the case of zero total momentum) is the existence of the energy gap in the unperturbed spectrum. (auth)

3107 MANDELSTAM THEORY AND REGGE POLES. An Introduction for Experimentalists. R. Omnès and M. Froissart. Frontiers in Physics. A Lecture Note and Reprint Series. New York, W. A. Benjamin, Inc., 1963. 133p. $8.00(cloth edition); $3.95(paperback edition).

An elementary introduction to the theory of strongly interacting elementary particles is presented, with consideration of both relativistic and nonrelativistic problems experimental tests of the Regge-pole hypothesis are also considered. (D,C.W.)

3108 INVARIANCE PRINCIPLES AND ELEMENTARY PARTICLES. J. J. Sakurai. Investigations in Physics. Princeton, N. J., Princeton University Press, 1964. 333p. $8.50.

Invariance principles and their applications to elementary particle physics are discussed, with consideration of continuous space-time transformations, parity, time reversal, charge conjugation, strong reflection and the CPT theorem, γ_5 invariance and weak interactions, gauge transformations and number laws, and isospin and related topics. Some remaining problems are also outlined. (D.C.W.)

3109 COMPLEX ANGULAR MOMENTA AND PARTICLE PHYSICS. A Lecture Note and Reprint Volume. Euan J. Squires. Frontiers in Physics. A Lecture Note and Reprint Series. New York, W. A. Benjamin, Inc., 1963. 172p. $9.00 (cloth edition); $4.95 (paper back edition).

The continuation of partial-wave amplitudes away from physical values of angular momentum is treated first, together with the properties of the continued amplitude. Potential scattering theory and relativistic s-matrix theory are then considered. Applications to particle interactions are also discussed, together with experimental support for the theory. (D.C.W.)

3110 PHYSIQUE NUCLÉAIRE ET PHYSIQUE MÉSIQUE. (Nuclear Physics and Meson Physics). Théo Kahan. Collection Armand Colin No. 375. Section de Physique. Paris, Librairie Armand Colin, 1963. 240p.

The major problems excited by research on nuclear structure and the nature of elementary particles are reviewed. The basic concepts; detection of particles; natural radioactivity; alpha, beta, and gamma rays, interaction between particles; neutrons; nuclear forces; accelerators; nuclear reactions; fission; chain reactions; and nuclear magnetism are discussed in the section on nuclear physics. In the section on meson physics, the physics of elementary particles, strange particles, nucleon structure, physics of hypernuclei, reality, symmetry, and parity are considered. (J.S.R.)

Field Theory and Quantum Mechanics

3111 (AD-601193) IF MICRONS WERE FERMIS. H. C. Corben (Thompson Ramo Wooldridge Inc. TRW Space Technology Labs., Redondo Beach, Calif.). Feb. 1964. 16p. $0.50(OTS).

Evidence is rapidly accumulating that elementary particle states are simply the rotational levels of a symmetrical top, as derived from relativistic quantum mechanics. Some of this evidence is presented for the case of zero-strangeness bosons. An analogy is drawn between this point of view and the non-relativistic theory of the rotational levels of a rigid molecule. (auth)

3112 (BNL-8533) REPORT ON SOME RECENT WORK ON HIGHER SYMMETRIES. L. A. Radicati (Brookhaven National Lab., Upton, N. Y.). Oct. 1964. Contract AT-30-2-GEN-16. 19p. (CONF-796-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 3rd Eastern Theoretical Physics Conference, College Park, Md., Oct. 1964.

The SU_4 and Sp_6 symmetry schemes are discussed. Schwinger's field theoretical model and symmetry between vector and axial vector currents in weak interactions are also discussed. (R.E.U.)

3113 (CAR-882-1) A BIRDS-EYE VIEW OF S-MATRIX THEORY. R. E. Cutkosky (Carnegie Inst. of Tech., Pittsburgh). [1964]. Contract AT(30-1)-882. 16p. (CONF-796-2). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 3rd Eastern Theoretical Physics Conference, College Park, Md., Oct. 1964.

The problems of S-matrix "theory" are described; descriptive and constructive questions and methods in formal and empirical S-matrix theory are considered. (R.E.U.)

3114 (NP-14346) PRINTSIP PRICHINNOSTI I ASIMPTOTICHESKOE POVEDENIE AMPLITODY RASSEYANIYA. (The Principle of Causality and Asymptotic Behavior of the Scattering Amplitude). N. N. Meiman (Akademiya Nauk S.S.S.R. Institut Teoreticheskoi i Eksperimental'noi Fiziki, Moscow and U.S.S.R. Sovet Ministrov. Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii). 1964. 28p. Dep.(mn).

Consideration is given to the elastic scattering reaction $p + \kappa \rightarrow p' + \kappa'$; where p and p' are the four-momenta of particle b before and after scattering, respectively, and κ and κ' are likewise for particle a. Let $A_+(s;t)$ be the reaction amplitude and $A_-(s;t)$ be the amplitude of the cross-reaction $p - \kappa' \rightarrow p' - \kappa$. The two auxiliary amplitudes $A_\infty^{ret}(s;t)$ and $A_\infty^{adv}(s;t)$ are introduced such that the difference $A_+ - A_\infty^{ret}$ tends to zero at high energy in the physical domain of the reaction, and the difference $A_- - A_\infty^{adv}$ tends to zero in the physical domain of the cross-reaction. It is proved that A_∞^{ret} and A_∞^{adv} are analytical of S in the upper and lower half-planes, respectively, and that the growth is slower than any linear exponent at complex infinity. With that, proceeding from micro-causality, the structure of admissible distributions is obtained. The distributions may

contain δ-function derivatives of all orders, i.e., they may not be the distributions of moderate growth, as it is always considered. Using A^{ret}_{ω} and A^{adv}_{ω}, Pomeranchuk's theorem about the asymptotic equality of particle and antiparticle total cross sections and about the asymptotic equality of differential cross sections is proved without an assumption of scattering amplitude analyticity. Therefore the experimental confirmation of the cross section equalities (if it will be established) can not be considered as the absolute argument in behalf of the amplitude analyticity. (auth)

3115 (UCRL-10843) STUDIES IN THE FOUNDATIONS OF S-MATRIX THEORY. Henry P. Stapp (California. Univ., Berkeley. Lawrence Radiation Lab.). Aug. 7, 1963. Contract W-7405-eng-48. 114p. Dep.(mn); $4.00(cy), 2(mn) OTS.

An axiomatic approach to S-matrix theory used earlier is developed in more detail. Certain of the postulates are made weaker and are brought closer to physically verifiable propositions. The viewpoint adopted is that the axioms should, whenever possible, be assertions of specific, verifiable physical relations rather than abstract general principles. This tends to eliminate ambiguities and superfluous entities, to cement theory to experiment, and to establish a secure logical framework. The paper is the first of a series and is devoted to detailed proofs of the fundamental consequences of the first few axioms. In particular, the unitarity of the S matrix is derived from a completeness property that incorporates the possibility of superselection rules. The relation between spin and representations of the rotation group is derived from the defining experimental characteristics of spin. The necessary existence of an S matrix whose connected part M_c is a Lorentz invariant function is derived from the assumed relativistic invariance of experimental correlations. A general theorem is proved that asserts, roughly, that a function that is (real) Lorentz invariant anywhere is complex Lorentz invariant everywhere in its domain of regularity. It is shown that the analytic continuations of M_c from regular points in the physical region of a given process along paths generated by the complex Lorentz transformations lead to a function that is single-valued in a neighborhood of all of these paths. Applications are discussed. The results derived constitute the preliminaries to a discussion of the analytic structure of the S matrix to be given in a subsequent paper. (auth)

3116 RELATIONSHIPS OF WAVE PACKET VARIANCES. Dick H. Holze and William T. Scott (Univ. of Nevada, Reno). Am. J. Phys., 32: 853-6(Nov. 1964).

Some results of interest in quantum measurement theory are derived from a consideration of a collision between two one-dimensional Gaussian wave packets. Relations are found between the momentum and position uncertainties of the packets before and after the collision. It is shown that the coordinates of a poorly defined packet can be better defined by causing it to collide with a well-defined packet. A classical analog is presented in which the same results are obtained. (auth)

3117 THE SCHWARZSCHILD METRIC AND THE WHITEHEAD THEORY OF GRAVITATION. A. L. Harvey (Queens Coll., New York). Am. J. Phys., 32: 892-4(Nov. 1964).

The relation of the Einstein and Whitehead theories of gravitation is discussed, with specific consideration of the Schwarzschild metric. (D.C.W.)

3118 ON QUASI-FREE POLYLOCAL FIELDS AND FIELDS OF INFINITE SPIN. R. F. Streater (Imperial Coll. of Science and Tech., London). Ann. Phys. (N. Y.), 30: 1-9(Oct. 20, 1964).

A method for constructing polylocal fields (depending on many space-time variables) similar to the generalized free field in one variable is given. The fields satisfy all the axioms given previously. A special case of the polylocal field may be said to correspond to a local field of infinite spin. The one-particle state of such a theory is infinitely degenerate unless the one-particle unitarity condition holds. In certain cases the existence of localized von Neumann algebras (Haag-Araki algebras) can be proved. The spacelike asymptotic condition in the form suggested by Haag and Ruelle holds, and one may expect the interpretation of the theory in terms of asymptotic states. (auth)

3119 STATIONARITY AND THE RANDOM PHASE CONDITION IN THE STATISTICAL THEORY OF THE ELECTROMAGNETIC FIELD. Y. Kano (Univ. of Rochester, N. Y.). Ann. Phys. (N. Y.), 30: 127-37(Oct. 20, 1964).

The quantum mechanical analog of the classical definition of stationarity of an electromagnetic radiation field is discussed. It is shown to imply that for an ensemble radiation field corresponding to a single momentum-spin state the phase space distribution function of the complex eigenvalues of the photon annihilation operators does not depend on the phases of the eigenvalues, i.e., the stationarity condition implies a uniform distribution of the phase angles of the eigenvalues. However, for a radiation field with a finite or countable infinite number of states, the stationarity condition is not a sufficient condition for the phase independence of the distribution function; it is shown that, in addition, the commutability of the density matrix and the number operator for each mode is required. The physical meaning of this commutability is investigated and it is shown to imply homogeneity of the radiation field. (auth)

3120 THE MOTION OF A PARTICLE OF FINITE MASS IN AN EXTERNAL GRAVITATIONAL FIELD. Moshe Carmeli (Israel Inst. of Tech., Haifa). Ann. Phys. (N. Y.), 30: 168-77(Oct. 20, 1964).

The analogy between the electromagnetic and the Einstein gravitational field theories raises the question as to whether the motion of a particle of finite mass moving in a gravitational field may be described in terms of an external gravitational field. There are many ways of defining the external field, and it is difficult to decide which to choose. It is shown that an inertial mass M can be defined in such a way that the EIH equations are derivable from the geodesic equation in the external field, this being defined as the field obtained from the whole field by putting M = 0. It turns out, however, that the analogy between the electromagnetic and the gravitational cases is not a close one—terms proportional to the square of the mass do not necessarily describe reaction forces; these appear even in the 6th order, in which the problem of gravitational radiation has not yet arisen. Moreover, certain terms defined as external field functions are reduced, on the basis of the equations of motion, to terms proportional to the square of the mass. (auth)

3121 MASS QUANTIZATION OF ZERO-SPIN PARTICLES. S. V. Lele and A. V. Lagu (Banaras Hindu Univ., Varanasi, India). Current Sci. (India), 33: 520(Sept. 5, 1964).

An imaginary co-ordinate transformation for the mass quantization of zero-spin particles is suggested by which the field equation and its underlying metric are invariant under Lorentz transformation. (D.C.W.)

3122 THE LEE MODEL AS SCATTERING SYSTEM. L. B. Redei (Univ. of Edinburgh, Eng.). Helv. Phys. Acta, 37: 391-408(1964).

The mathematical structure of the Lee model as a scattering system is investigated. The Lee model is exactly soluble in one of its invariant subspaces. In order to establish the existence of a wave operator, the eigenvalue problem is solved in terms of a family of projection operators, rather than improper eigenstates. The wave operator and scattering operator are defined and evaluated. (T.F.H.)

3123 THE SIMPLE SCATTERING SYSTEM WITH DECAYING STATES. J.-P. Marchand (Universite, Geneva). Helv. Phys. Acta, 37: 475-92(1964). (In French)

Decay phenomena are studied with the framework of scattering theory. Starting with simple scattering theory, it is assumed that upon the continuous spectrum of the free Hamiltonian H_0 are situated n proper values E_ν, which disappear under the influence of a potential $V = H - H_0$. The

role of decaying states is then played by the proper vectors φ_ν associated with the energies E_ν. A potential model is used that permits the elimination from the wave operators of expressions that rely on spectral representations with respect to H_0 and H. (T.F.H.)

3124 DIRECT CALCULATION OF ENERGY EIGENVALUE SPECTRA FROM TIME EVOLUTION OF NONSTATIONARY STATES. S. M. Blinder (Univ. of Michigan, Ann Arbor). J. Chem. Phys., 41: 3412-16(Dec. 1, 1964).

An arbitrary function in the eigenfunction space of some quantum-mechanical hamiltonian may be thought to represent the initial configuration $\psi(q,0)$ of a nonstationary state. The system develops in time according to $\psi(q,t) = \exp(-it\mathfrak{H})\psi(q,0) = \sum_{k=0}^{\infty} [(-it)^k/k!]\mathfrak{H}^k\psi(q,0)$. Defining $F(t) \equiv \langle\psi(q,0), \psi(q,t)\rangle$, and $h_k \equiv \langle\psi(q,0), \mathfrak{H}^k\psi(q,0)\rangle$, and taking the Fourier transform $G(\omega) = \int_{-\infty}^{\infty} dt \exp(-i\omega t)F(t)$, $G(\omega) = 2\pi\sum_{k=0}^{\infty}(h_k/k!) \times \delta^{(k)}(\omega)$ is obtained. In terms of the formal expansion in the energy eigenfunctions $\psi(q,0) = \sum_{n=0}^{\infty} c_n\phi_n(q) + \int_0^{\infty} d\omega c(\omega)\phi(\omega,q)$, the Fourier transform represents $G(\omega) = 2\pi\sum_{n=0}^{\infty}|c_n|^2\delta(\omega + \omega_n) + 2\pi|c(-\omega)|^2$, (b) which exhibits, in principle, the entire eigenvalue spectrum. A direct method of calculating eigenvalue spectra, based on the foregoing principle, is proposed. Two modifications are required for computational practicability: use of a finite representation for the delta function and truncation of the summation; and replacement of the integrals h_k by $h_k(q') \equiv \mathfrak{H}^k\psi(q,0)_{q=q'}$. The modified spectral function is taken to be $G_N(\tau,\omega,q') = 2\pi\sum_{k=0}^{N}[h_k(q')/k!]\chi_\tau^{(k)}(\omega)$, with $\chi_\tau(\omega) \equiv \sin\tau\omega/\pi\omega$. The sequence $G_N(\tau,\omega,q')$ is shown to converge as $N \to \infty$ if in the expansion (b) the coefficients c_n and $c(\omega)$ decrease with ω as $\exp(-\omega/\lambda)$ or faster. Assuming convergence, the spectral function represents a broadened eigenvalue spectrum. (auth)

3125 DEGENERACY OF EIGENVALUES OF REDUCED DENSITY MATRICES AND TIME-REVERSAL INVARIANCE FOR ELECTRON SYSTEMS. David Micha (Uppsala Univ.). J. Chem. Phys., 41: 3648-9(Dec. 1, 1964).

The calculation of mean values of operators of a many-electron system may be done by using only the reduced density matrices of the system, so that the knowledge of their properties may be useful. Some of the relations between the symmetries of the system and those of the reduced density matrices and the degeneracy that they imply are defined. (P.C.H.)

3126 APPROXIMATION OF THE DIRAC DENSITY MATRIX. Herbert Payne (Aerospace Research Labs., Wright-Patterson AFB, Ohio). J. Chem. Phys., 41: 3650-1 (Dec. 1, 1964).

An improved formula for $\rho(r,r)$ containing a correction ∇V is proposed for a fermion system. It behaves in accordance with wave mechanics where $\epsilon - V$ is small or negative. (P.C.H.)

3127 DIFFERENTIAL-GEOMETRIC ELEMENTS OF ANALYTIC DYNAMICS. Richard Arens (Univ. of California, Los Angeles). J. Math. Anal. and Appls., 9: 165-202(Oct. 1964).

The basic mathematical and dynamical concepts of analytic dynamics are presented. The reduction of Pfaffians (covariant vector fields) to normal form using the Hamilton-Jacobi technique is considered, and the variational theory of Pfaffians is presented on which Hamilton's action-principle is based. Manifolds and their phase spaces are discussed, and the variational principle of Lagrange is reviewed and related to that of Hamilton. Absolute mechanical systems are then considered. (D.C.W.)

3128 MOTION OF A CHARGED PARTICLE IN INHOMOGENEOUS MAGNETIC FIELD. Hiromichi Kondo and Katsushi Toshioka (Mitsubishi Electric Corp., Amagasaki, Japan). J. Phys. Soc. Japan, 19: 1731-3(Sept. 1964).

The motion of a charged particle in a static magnetic field parallel to the z direction and which varies monotonously in magnitude in the y direction, tending to zero, is investigated. (D.C.W.)

3129 AN EXAMINATION OF FANO'S "THEOREM OF HOMOGENEITY" BY X-RAYS. Masanao Hosoe, (St. Paul's Univ., Tokyo), Sayo Chin, and Eizo Tajima. J. Radiation Res. (Japan), 4: 59-67(June, Sept., Dec., 1963).

The limitation of Fano's theorem of homogeneity was investigated using homogeneous CH_2 under x irradiation. Variations of ionization current with the pressure of ethylene gas in a parallel plate polyethylene chamber were observed. The nonlinearity obtained in the I-P curve, ionization current vs. pressure of gas, was attributed to the deviation from the assumption of the theorem. This deviation is considered to be due to the effect of chemical aggregation on the behavior of slow electrons. (auth)

3130 GENERAL RELATIVITY: SELECTED TOPICS OF CURRENT INTEREST. D. R. Brill (Yale Univ., New Haven). Nuovo Cimento (1), 2: Suppl., 3-56(1964).

Geometrodynamics and gravitational radiation are discussed. In the area of geometrodynamics the geometrization procedure is treated in detail because the example of the scalar field provides an excellent, simple way to gain insight into this fundamental procedure of geometrodynamics. Emphasis is placed on the axially symmetric gravitational waves because there are indications that this relatively simple case already contains most of the main features of gravitational radiation in general. (C.E.S.)

3131 ANALYTICITY OF FIELD THEORY. J. G. Taylor (Univ. of Cambridge, Eng. and Churchill Coll., Cambridge, Eng.). Phys. Rev., 136: B1134-6(Nov. 23, 1964).

It is proved that a generalized field theory has the same minimum surfaces of singularities in the external momenta as Chew's S-matrix, given by all the possible Landau surfaces of singularity of the related perturbation theory. This implies in particular that Lagrangian field theories are a special class of models satisfying the S-matrix postulates. (auth)

3132 THREE-BODY SCATTERING AMPLITUDE. II. EXTENSION TO COMPLEX ANGULAR MOMENTUM. Roland L. Omnes and Victor A. Alessandrini (Univ. of California, Berkeley). Phys. Rev., 136: B1137-53(Nov. 23, 1964). (UCRL-11186; UCRL-11186(Rev.1))

The extension of the nonrelativistic three-body scattering amplitude to complex values of the total angular momentum is investigated. (D.C.W.)

3133 SINGULAR LOGARITHMIC POTENTIALS AND PERATIZATION. H. H. Aly, Riazuddin, and A. H. Zimerman (Univ. of Rochester, N. Y.). Phys. Rev., 136: B1174-5(Nov. 23, 1964). (UR-875-42)

Logarithmic singular potentials are considered to test the applicability of the peratization technique. It is shown that if the leading singular terms in each order of the perturbation series are summed, no finite results can be obtained. (auth)

3134 SCATTERING BY THE SINGULAR POTENTIAL $-gr^{-4}$ ln r. Tai Tsun Wu (Univ. of Wisconsin, Madison). Phys. Rev., 136: B1176-83(Nov. 23, 1964).

In connection with higher-order leptonic weak interactions, divergent series containing an infinite number of logarithmic factors are encountered. In order to have some understanding of series of this type, the problem of scattering by the singular potential $-gr^{-4}$ ln r is studied for the case of zero energy. Generalization to the potential $-gr^{-\lambda}$ ln r with $\lambda > 3$ is also considered. (auth)

3135 PHYSICAL SIGNIFICANCE OF OPERATORS IN QUANTUM OPTICS. L. Mandel (Univ. of Rochester, N. Y.). Phys. Rev., 136: B1221-4(Nov. 23, 1964).

The relation between normally ordered and unordered products of creation and annihilation operators is studied, and it is emphasized that the former correspond to counting correlations and the latter to counting moments. Both can be measured. It is shown that a particularly simple relation exists between the generating functions for the two kinds of products. This relation can also be obtained by semiclassical considerations, which give more insight into its significance. The result provides further indication of the very close connection between the semiclassical and quantum-mechanical theories of optical coherence. (auth)

3136 GRAVITATIONAL RADIATION AND THE MOTION OF TWO POINT MASSES. P. C. Peters (California Inst. of Tech., Pasadena). Phys. Rev. 136: B1224-? (Nov. 23, 1964).

The expansion of the field equations of general relativity in powers of the gravitational coupling constant yields conservation laws of energy, momentum, and angular momentum. From these, the loss of energy and angular momentum of a system due to the radiation of gravitational waves is found. Two techniques, radiation reaction and flux across a large sphere, are used in these calculations and are shown to be in agreement over a time average. In the nonrelativistic limit, the energy and angular momentum radiation and angular distributions are expressed in terms of time derivatives of a quadrupole tensor. These results are then applied to a bound system of two point masses moving in elliptical orbits. The secular decays of the semimajor axis and eccentricity are found as functions of time and are integrated to specify the decay by gravitational radiation of such systems as functions of their initial conditions. (auth)

3137 PHOTON AS A SYMMETRY-BREAKING SOLUTION TO FIELD THEORY. [PART] I. G. S. Guralnik (Imperial Coll. of Science and Tech., London). Phys. Rev., 136: B1404-16(Dec. 7, 1964).

The mechanism which guarantees the consistency of the angular-momentum conservation and commutation rules of a Lorentz-invariant theory with the requirement that the vacuum expectation of a vector operator be nonvanishing is studied. A theory, originally proposed by Bjorken, which reproduces ordinary electrodynamics is presented in a manner which allows the calculation of the parameters of the theory. In particular the "consistency condition" is displayed and found to be quadratically, not cubically, divergent. It is shown that the original Bjorken solution occurs when the cutoff condition of the theory is taken literally. This attitude results in difficulties with current conservation and leads to transitions between the standard vacuum and anomalous degenerate states. These transitions alone, and not the ones directly involving the massless vector particles induced by the broken symmetry, are responsible for the ultimate consistency of the theory. An alternative formulation of the theory which does not take the cutoff so seriously and places emphasis on the underlying operator structure rather than the perturbation Green's functions of the theory, is proposed. This presentation is essentially equivalent to the original formulation since it differs only by gauge terms. However, in this case no difficulty is encountered with current conservation and the theory is consistent in the manner required by normal formulations of the Goldstone theorem. (auth)

3138 PHOTON AS A SYMMETRY-BREAKING SOLUTION TO FIELD THEORY. [PART] II. G. S. Guralnik (Imperial Coll. of Science and Tech., London). Phys. Rev., 136: B1417-22(Dec. 7, 1964).

A spin-zero field coupled to itself by a current-current interaction is studied subject to the requirements that the vacuum expectation of the current be nonvanishing. It is found that this theory is equivalent to the ordinary electrodynamics of a spinless particle. In all its broken-symmetry aspects, the theory is similar to the Bjorken theory for Fermi particles, although the calculations necessary to arrive at this conclusion are more complex. (auth)

3139 BOUNDS ON PROPAGATORS, COUPLING CONSTANTS, AND VERTEX FUNCTIONS. S. D. Drell, A. C. Finn, and A. C. Hearn (Stanford Univ., Calif.). Phys. Rev., 136: B1439-51(Dec. 7, 1964). (SLAC-Pub-39)

Several bounds on renormalization constants and on the asymptotic behavior of propagation functions and vertices are constructed. The inputs are experimental measurements and/or analyticity properties of vertex functions. The connection between zeros in propagators, poles in vertex functions, and the values of coupling constants is discussed, together with the possible physical significance of such zeros in terms of an extended Lee model. It is argued on the basis of this model and the scattering amplitude derived from it that there is no reason to exclude the existence of zeros in the propagator. This negates the arguments given for bounding the coupling constants in field theory. (auth)

3140 DICHROISM OF THE VACUUM. James J. Klein and B. P. Nigam (State Univ. of New York, Buffalo). Phys. Rev., 136: B1540-2(Dec. 7, 1964).

Using Schwinger's expression for the Lagrangian density for the electromagnetic field in vacuum, including vacuum polarization effects, the imaginary part of the Lagrangian density is calculated to order e^2 from the pole contributions. It is found that in the presence of a strong electric field $E \sim \pi m^2/e \sim 10^{16}$ v/cm, there is strong absorption of light polarized in a direction parallel to the electric field, the vacuum thus exhibiting a phenomenon analogous to dichroism in polaroids. (auth)

3141 PARITY, CHARGE CONJUGATION, AND TIME REVERSAL IN THE GRAVITATIONAL INTERACTION. J. Leitner (Syracuse Univ., N. Y.) and S. Okubo. Phys. Rev., 136: B1542-6(Dec. 7, 1964).

Some consequences of possible violation of parity (P), charge conjugation (C), time reversal (T), and TCP invariance in the gravitation interaction are discussed and compared with existing experimental evidence. The evidence suggests TCP (or CP or C) invariance, but separate violation of P, C, and T cannot be ruled out. (auth)

3142 ANALYTICAL RELATIVISTIC SELF-CONSISTENT FIELD THEORY. Miroslav Synek (DePaul Univ., Chicago). Phys. Rev., 136: A1552-60(Dec. 14, 1964).

The analytical self-consistent field (SCF) theory, based on the relativistic Breit equation generalized for many particles, was developed for closed-shell systems. The relativistic SCF equations, both of the absolute and of the expansion method type, were derived in the four-component spinor representation. The Breit operator was considered in the first-order perturbation theory. The formulas for the relativistic atomic integrals were derived in terms of simple functions. (auth)

3143 SPINORIAL FIELD THEORIES AND NOETHER'S THEOREM IN CURVED SPACE-TIME. Ernst Schmutzer (Universität, Jena, Ger.). Z. Naturforsch., 19a: 1027-31 (Sept. 1964). (In German)

On the basis of a curved space-time with Riemannean geometry the conception of spinors was analyzed. It is shown that a consequent treatment of spinors as invariants with respect to coordinate transformations (Sommerfeld's first point of view) gives the well-known energy-momentum-tensor and the correct spin integral. For this purpose it was necessary to develop Noether's theorem in such a way that not the metric tensor g_{mn} but the metric spintensor is the fundamental metrical quantity. This fact is the cause that the Belinfante tensor expression cannot be applied. A tensor expression for spinor fields was derived. In this connection Dirac's theory and Heisenberg's theory were investigated. (auth)

3144 THE SCHWARZSCHILD SOLUTION IN A UNITARY FIELD THEORY. G. Braunss (Technische Hochschule, Darmstadt, Ger.). Z. Naturforsch., 19a: 1032-3 (Sept. 1964). (In German)

It is shown that the system of field equations $1/\kappa\, G_{mn}(\Phi) \equiv 1/\kappa(R_{mn} - \frac{1}{2}g_{mn}R) = k_0/2\,[g_{mn}(g^{ab}\Phi_{,a}\Phi_{,b} + F(\Phi)) - \Phi_{,m}\Phi_{,n}]$, in which the g_{mn} are to be considered as functionals of the world field Φ, possesses a nonsingular static central symmetrical solution, which, assuming $F(\Phi) \sim -\Phi^6$, is identical with the Schwarzschild solution up to terms of higher order for large values of r. (auth)

3145 ELECTROMAGNETIC FIELDS AND INTERACTIONS, VOLUME I, ELECTROMAGNETIC THEORY AND RELATIVITY. Richard Becker and Fritz Sauter, ed. Translated from Theorie der Elektrizitat. A Blaisdell Book in the Pure and Applied Sciences. New York, Blaisdell Publishing Company, 1964. 449p. $9.50.

An introduction to tensor calculus is followed by a survey of: electrostatic fields; electric currents and magnetic fields; general fundamental equations of electromagnetic fields; relativity theory and relativistic electrodynamics and mechanics; and tabulations of formulas. (T.F.H.)

3146 ELECTROMAGNETIC FIELDS AND INTERACTIONS. VOLUME II. QUANTUM THEORY OF ATOMS AND RADIATION. Richard Becker and Fritz Sauter, ed. Translated by Ivor de Teissier from Theorie der Elektrizitat. A Blaisdell Book in the Pure and Applied Sciences. New York, Blaisdell Publishing Company, 1964. 410p. $9.50.

A survey is presented of: the classical and relativistic theories of the electron; the principles of quantum mechanics; one-electron and several-electron problems; and radiation theory. (T.F.H.)

Geophysics

Refer also to abstracts 2939, 2943, 2944, and 3004.

3147 (D1-82-0372) GEOPHYSICAL EFFECTS OF HIGH-ALTITUDE NUCLEAR EXPLOSIONS. J. F. Kenney and H. R. Willard (Boeing Scientific Research Labs., Seattle). Aug. 1964. 64p. (CONF-687-2).

From Meeting of the Latin-American Council for Cosmic Radiation and Space Physics, Tucuman and Buenos Aires, Aug. 1964.

In 1962, both the Russians and the Americans conducted a series of high altitude nuclear explosions which had widespread geophysical effects. A study of these effects is useful to the geophysicist if it will shed light on the mechanisms responsible for similar geophysical phenomena which are noted in association with normally occurring disturbances. A review is presented of the effects of nuclear testing, with special emphasis on the trapped radiation, the ionosphere, and magnetic disturbances. An interpretation of these different phenomena is made. (auth)

3148 (RTD-TDR-63-3097) SIMULATION AND PROTOTYPE CONSTRUCTION— PROJECT CANTALOUPE. Final Report. (Republic Aviation Corp., Farmingdale, N. Y.). Aug. 1964. Contract AF29(601)-2866. 94p. (AD-606249). $4.00(OTS).

The report (Project Cantaloupe) was directed toward understanding the instabilities in expansion of a nuclear-detonation plasma into the geomagnetic field at high altitudes. A theta-pinch apparatus specifically designed for the purpose was used to study Rayleigh-Taylor instabilities at a plasma-magnetic field interface. Special features include pre-ionization, a pulse-shaping network, and a provision for transverse as well as axial photography. A constant magnetic field results in a constant velocity radial compression, in good agreement with "snowplow" theory. In this case, as expected, no surface instabilities are observed. A sinusoidal compression field, however, results in instabilities whose wavelength and growth rate are measured. Theoretical dispersion relations for finite electrical conductivity and for finite viscosity are derived. In addition, the mode of maximum instability is determined. These relations are compared with the experimental results. The observed wavelength (assumed to be the wavelength of maximum instability) and its growth rate are in agreement with the assumption that the effect of viscosity must be retained in the dispersion relation. The dispersion relation in the present case is independent of the electrical conductivity. While previous investigators have attempted to correlate observed wavelengths with finite electrical conductivity, this is shown here to be unwarranted. (auth)

3149 GEOMAGNETIC AND IONOSPHERIC EFFECTS AT BRISBANE FOLLOWING THE NUCLEAR EXPLOSION ON JULY 9, 1962. G. G. Bowman and J. S. Mainstone (Univ. of Queensland, Brisbane). Australian J. Phys., 17: 409-17(Sept. 1964).

Ionospheric data and geomagnetic micropulsation records from Brisbane have revealed both short-term and delayed effects associated with the nuclear explosion on July 9, 1962 above Johnston Island. The initial ionospheric effects, lasting about 30 sec, appeared to be due to severe low-level (D-region) blanketing, probably arising from the dumping of neutron decay products. The micropulsations initiated by the explosion were detected for about 5 min; after an initial transient, they became suppressed during the time in which the low-level blanketing ionization was present. The delayed ionospheric effects were seen most clearly in the F region. Three pressure-wave disturbances with speeds of 840, 330, and 220 m/sec produced pronounced decreases in Δf_0F_2, the departure from the monthly mean. It would seem also that the explosion gave rise to a substantial hydromagnetic wave which spread around the world with a speed of 1420 m/sec. This wave produced impulsive micropulsation bursts and significant increases in Δf_0F_2 as it passed over Brisbane, probably due to precipitation from the artificial radiation belt. The periodical bursts of micropulsations persisted for at least 24 hr. (auth)

3150 BALL LIGHTNING. Vaclav A. Petrzilka (Ustav Fyziky Plazmatu CSAV, Prague). Cesk. Casopis Fys., No. 6, 542-7(1964). (In Czech.)

The properties of ball lightning, its models, and the possible relation between the theory of ball lightning and the theory of plasma are presented. Ball lightning is described, along with a detailed account of experimental facts obtained by random observations, models of ball lightning, and the possibility of using the results of the quantum theory of solids in the physics of superdense high-temperature plasma. (auth)

3151 THE TERRESTRIAL RING CURRENT. Ernest C. Ray (Rand Corp., Santa Monica, Calif.). J. Geophys. Res., 69: 4421-7(Nov. 1, 1964).

An approximate formula for the magnetic field associated with an axially symmetric body of plasma in a dipole magnetic field is derived, without selecting a particular functional form for the plasma density. (D.C.W.)

3152 LABORATORY STUDIES OF THE VARIATION OF THE MAGNETOSPHERE WITH SOLAR WIND PROPERTIES. F. J. F. Osborne, M. P. Bachynski, and J. V. Gore (RCA Victor Co., Montreal). J. Geophys. Res., 69: 4441-9(Nov. 1, 1964).

A scale model laboratory experiment simulating the effect of the solar wind on the magnetosphere was performed. On the basis of photographic and magnetic field measurements, two distinct types of interactions, depending on the properties of the solar wind, can be distinguished. The "standoff" interaction shows a complete standoff of the impinging solar wind plasma at several earth radii away from the terrella. No visible injection of the wind into the region of the terrella is observed. A very steep gradient of the magnetic field at the position of the standoff and the formation of discrete inner regions of plasma are found. The "injection" interaction is characterized by the injection at high latitudes of plasma into the vicinity of the terrella merging into a single wake or tail. The visible plasma regions to windward generally exhibit considerable radial thickness and diffuse edges. Magnetic measurements show a much more gradual compression of the magnetic field and no discrete inner regions. (auth)

3153 TIME CORRELATION OF EXTREME ULTRAVIOLET RADIATION AND THERMOSPHERIC TEMPERATURE. R. E. Bourdeau, S. Chandra, and W. M. Neupert (Goddard Space Flight Center, Greenbelt, Md.). J. Geophys. Res., 69: 4531-5(Nov. 1, 1964).

Thermospheric temperatures derived from satellite drag observations are compared with the intensity of extreme ultraviolet radiation (EUV) measured on the first Orbiting Solar Observatory (OSO 1). It is concluded that, for the two complete solar rotation periods during which the EUV data are available, the 27-day periodic variation in upper atmospheric density was due to corresponding changes principally of ultraviolet rather than corpuscular radiation. (auth)

3154 STUDIES OF PLANETARY ATMOSPHERES. 1. THE DISTRIBUTION OF ELECTRONS AND IONS IN THE EARTH'S EXOSPHERE. J. J. Angerami and J. O. Thomas (Stanford Univ., Calif.). J. Geophys. Res., 69: 4537-60(Nov. 1, 1964).

The factors which govern the distribution of electrons and ions in a planet's exosphere under diffusive equilibrium are discussed. The theory takes into account the effect of the electric field that arises from charge separa-

tion, the centrifugal force arising from the rotation of the planet, and the effect of the planet's gravitational field. It is assumed that the charged particles are constrained to move only along the direction of the planet's magnetic lines of force. The modifications that result in the electron and ion distributions when a temperature variation is assumed along a line of force are also considered. The results predicted by the theory are compared with experimental observations of the electron density distribution in the earth's exospheric plasma which were obtained in recent years from whistler data and from topside ionograms made by the Alouette satellite. (auth)

3155 ELECTRON DENSITY AT THE ALOUETTE ORBIT. J. O. Thomas and A. Y. Sader (Stanford Univ., Calif.). J. Geophys. Res., 69: 4561-81(Nov. 1, 1964).

Alouette topside soundings recorded at Stanford University were used to determine the diurnal, seasonal, and latitudinal variations of electron density at the orbit of the satellite (~1000 km) over a wide range of latitudes. The electron density is larger in summer than in winter by a factor of approximately 2 at the level of the satellite. The derived latitudinal distributions of electron density at the base of the exosphere are important to the theory of electron and positive ion distributions in the exosphere discussed by Angerami and Thomas. (auth)

3156 ABSORPTION AND PHOTOIONIZATION CROSS SECTIONS OF O_2 AND N_2 AT INTENSE SOLAR EMISSION LINES. James A. R. Samson and R. B. Cairns (Geophysics Corp. of America, Bedford, Mass.). J. Geophys. Res., 69: 4583-90(Nov. 1, 1964).

Photoionization and total absorption cross sections were measured for O_2 and N_2 at wavelengths below 1100 Å. The These wavelengths correspond to intense solar emission lines. The solar emission lines were reproduced in the laboratory using a high voltage condensed spark discharge and a d-c glow discharge. Most of the lines were completely resolved by the vacuum monochromator; thus, the wavelength bandpass was not limited to that of the monochromator, but rather to the widths of the lines generated within the light sources. The widths of these lines ranged from 0.04 to 0.1 Å. (auth)

3157 F-REGION ENHANCEMENTS IN THE ANTARCTIC. T. Sato and G. F. Rourke (Avco Corp., Wilmington, Mass.). J. Geophys. Res., 69: 4591-4607(Nov. 1, 1964).

Daily and seasonal variations of the monthly median F_2-region critical frequency (f_0F_2) in the Antarctic are studied. The abnormally large increase in f_0F_2 is found to be most distinctive in winter in the areas around Ellsworth, South Pole, Byrd, Little America, Cape Hallett, and Terre Adelie. Statistically, the increase occurs between 0400 and 0900 universal time, although individual days may differ. Synoptic maps of f_0F_2 indicate that areas of abnormally large f_0F_2 extend from the sunlit hemisphere across to the night hemisphere. Equivalent current systems of the magnetic variation coincide qualitatively with the f_0F_2-distribution patterns. An explanation for this anomaly is given which takes into account the horizontal drift motion of electrons in the F_2 region that is caused by the interaction of the electric field deduced from the magnetic S_q and S_d variation with the magnetic field in the polar regions. Time variations of the f_0F_2 worldwide distribution and of the F_2-region behavior as recorded on ionograms seem to support the drift theory. (auth)

3158 DIFFUSION AND ELECTROMAGNETIC DRIFT IN THE EQUATORIAL F_2 REGION. E. N. Bramley and M. Peart (Dept. of Scientific and Industrial Research, Slough, Bucks, Eng.). J. Geophys. Res., 69: 4609-16 (Nov. 1, 1964).

The results are presented of calculations of the equilibrium distribution of electron density in the F region of the ionosphere near the magnetic equator. The distributions are obtained as solutions of the continuity equation, including terms representing photoionization, loss, diffusion along geomagnetic field lines, and a small electromagnetic drift. It is found that the drift produces a significant effect and can give rise to results which conform more nearly to the observed distributions than do those obtained theoretically when drift is ignored. (auth)

3159 WEAK SHOCK WAVES IN THE IONOSPHERE. D. P. Hoult (Pennsylvania State Univ., University Park). J. Geophys. Res., 69: 4617-20(Nov. 1, 1964).

It is shown that in the D region of the ionosphere the shock formed by the nose of a sounding rocket introduces serious errors in measurement of the ionic composition of the region. A simple model of the chemistry of the ionosphere is developed, which correctly predicts the equilibrium composition of the D region as estimated by Nicolet and Aikin. Using this model, the chemical structure of a weak shock in the ionosphere is calculated. The result is compared with an equilibrium calculation. The effects of impurities are discussed. (auth)

3160 SOME RESULTS OF ROCKET EXPERIMENTS IN THE QUIET D REGION. A. C. Aikin, J. A. Kane, and J. Troim (Goddard Space Flight Center, Greenbelt, Md.). J. Geophys. Res., 69: 4621-8(Nov. 1, 1964).

Two electron density profiles were obtained for the quiet-day mid-latitude D region by means of ground to rocket radio propagation experiments. These profiles are interpreted between 85 and 70 km in terms of solar Lyman α ionization of nitric oxide. The role of 2- to 8-Å x rays is shown to be unimportant to the formation of the D region for the quiet solar conditions present during the two rocket flights. The electron collision frequency in the D region is shown to be subject to significant variations which are correlated to pressure variations of the stratosphere. (auth)

3161 FIRST ELECTROSTATIC PROBE RESULTS FROM EXPLORER 17. L. H. Brace and N. W. Spencer (Goddard Space Flight Center, Greenbelt, Md.). J. Geophys. Res., 69: 4686-9(Nov. 1, 1964).

The variations of electron temperature and positive ion density observed over Blossom Point, Maryland, are reported, and the implications of the data are discussed. (D.C.W.)

3162 MAXIMUM DURATION OF DISCRETE VERY LOW FREQUENCY EMISSIONS. N. Brice (Stanford Univ., Calif.). J. Geophys. Res., 69: 4698-4700(Nov. 1, 1964).

An upper limit for the maximum duration of long-lasting ionospheric emissions with quasi-constant frequencies was derived and was used to test six mechanisms suggested for the generation of the emissions. It was concluded that the transverse resonance plasma instability for electrons was the most probable explanation of the six considered. (D.C.W.)

3163 A QUALITATIVE EXPLANATION OF THE DIURNAL VARIATION OF CHORUS. N. Brice (Stanford U Univ., Calif.). J. Geophys. Res., 69: 4701-3(Nov. 1, 1964).

It is suggested that the v-l-f emissions called chorus are generated by the transverse resonance plasma instability for electrons and that the production of this instability requires anisotropy in the electron velocity distribution. Phenomena which might give rise to the required anisotropy are considered. It is suggested that the compression of the outer magnetosphere by the solar wind would assist in producing the anisotropy. While no attempt is made to explain the systematic shift in the time of maximum chorus occurrence with latitude, it is shown that the compression of the magnetosphere leads to an explanation of the observation that chorus is generally observed between dawn and noon. A conservative estimate of the rate of increase in transverse energy of energetic electrons arising from this compression is found to be orders of magnitude greater than that required to explain the energies observed in chorus. (auth)

3164 VERY LOW FREQUENCY EMISSION PERIODS AND WHISTLER-MODE GROUP DELAYS. R. A. Helliwell and N. Brice (Stanford Univ., Calif.). J. Geophys. Res., 69: 4704-8(Nov. 1, 1964).

Evidence is presented indicating that periodic emissions are generated through triggering by emissions echoing in the whistler mode. (D.C.W.)

3165 THE EFFECTS OF IONS ON LOW FREQUENCY AND VERY LOW FREQUENCY PROPAGATION IN AN ABNORMALLY IONIZED ATMOSPHERE. C. M. Crain and H. G. Booker (Rand Corp., Santa Monica, Calif.). J. Geophys. Res., 69: 4713-16(Nov. 1, 1964).

The effects of ions on sky-wave transmission in the l-f and v-l-f ranges during periods of abnormal ionization of the region below the normal D layer are demonstrated. (D.C.W.)

3166 ELECTRON COLLISION FREQUENCY IN THE IONOSPHERIC D REGION. Robert F. Benson (Univ. of Alaska, College). J. Res. Natl. Bur. Std., 68D: 1123-6 (Oct. 1964).

A brief review of information on the electron collision frequency ν in the ionospheric D region that is available from rocket observations and laboratory investigations indicates that the equation $\nu_m = 8.40 \times 10^7\, p(\text{mmHg})$ is accurate within about ±10% in the portion of the D region above 40 km. The results of a cross-modulation experiment at College, Alaska, are in agreement with this equation. (auth)

3167 IONOSPHERIC PHENOMENA AND SOLAR ACTIVITY. K. R. Ramanathan (Physical Research Lab., Ahmedabad, India). p.25-39 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

The more important advances in ionospheric physics are summarized, with consideration of the structure of the ionosphere; the topside of the ionosphere above the F2 peak; effects of the Starfish explosion on the ionosphere; and the effects of auroral, magnetic, and solar activity on the ionosphere. (D.C.W.)

3168 RADIATION BELTS AND SOLAR ACTIVITY. Paul J. Kellogg (Univ. of Minnesota, Minneapolis). p.233-58 of "International Conference on Cosmic Rays. Vol. 1." Bombay, Tata Inst. of Fundamental Research, 1964.

Measurements on the time variations, spectra, and precipitation of electrons and protons in the radiation belts and on the structure and particle fluxes in the magnetosphere are discussed, together with explanations proposed for the observed phenomena. Possible sources of the particles particularly are considered. (D.C.W.)

3169 ELECTRON DENSITY DISTRIBUTION IN IONOSPHERE AND EXOSPHERE. Proceedings of the NATO Advanced Study Institute, Skeikampen, Norway, 17-26 April, 1963. E. Thrane, ed. New York, Interscience Publishers, 1964. 400p. $13.50.

Papers (38) on experimental observations and associated theory of the ionization densities in the exosphere and ionosphere are included. (D.C.W.)

3170 THE STRUCTURE AND PHYSICS OF THE UPPER ATMOSPHERE. Thomas E. Van Zandt and Robert W. Knecht (National Bureau of Standards, Washington, D. C.). p.166-225 of "Space Physics." New York, John Wiley & Sons, 1964.

Some of the things known about the upper atmosphere and the ionosphere, as well as features not yet fully described, are reviewed. The following quantities in particular are considered: the electron-density distributions in the D region, the heliosphere, and the protonosphere; the ion composition throughout the ionosphere; the electron and ion temperatures; and the neutral temperature and composition, particularly in the 100- to 200-km region. Among the problems the causes of the variations of temperature and composition in the neutral atmosphere are only partly understood, and the theory of formation of the ionospheric layers is incomplete. (auth)

3171 AURORA AND GEOMAGNETIC STORMS. Sydney Chapman (Univ. of Alaska, College and High Altitude Observatory, Boulder, Colo.). p.226-69 of "Space Physics." New York, John Wiley & Sons, 1964.

An account is given of the temporal and geophysical distributions, spectra, morphology, magnetospheric currents, conjugate and other relationships, and theory of aurorae and geomagnetic storms. (88 references.) (T.F.H.)

3172 THE GEOMAGNETIC FIELD. Laurence J. Cahill, Jr. (National Aeronautics and Space Administration, Washington, D. C.). p.301-49 of "Space Physics." New York, John Wiley & Sons, 1964.

The properties of the main and outer geomagnetic fields and their variations are surveyed. Ionospheric and ring currents are discussed. The uses of satellites for geomagnetic field mapping are described. Interactions of the geomagnetic field with cosmic radiation are analyzed. 66 references. (T.F.H.)

3173 THE TRAPPED-RADIATION ZONES. Brian J. O'Brien (Rice Univ., Houston, Tex.) p.505-72 of "Space Physics." New York, John Wiley & Sons, 1964.

A survey is given of experimental measurements and theoretical interpretations of properties of the Van Allen belts. Particle types, spectra, sources, and loss mechanisms in the belts are the main topics of study. 113 references. (T.F.H.)

Low Temperature Physics

Refer also to abstract 2829.

3174 (LADC-6148) SECOND SOUND IN A RESONANT CAVITY IN HELIUM II. Philip Bendt (Los Alamos Scientific Lab., N. Mex.). Dec. 16, 1963. Contract W-7405-eng-36. 8p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Experimental results and calculations of second sound in a closed rectangular cavity with insulating walls completely submerged in a He II bath are presented. (R.E.U.)

3175 (NASA-CR-108) A THEORETICAL AND EXPERIMENTAL STUDY OF A SUPERCONDUCTING MAGNETICALLY SUPPORTED SPINNING BODY. Roger D. Bourke (Stanford Univ., Calif.). Oct. 1964. 134p. $2.75 (OTS).

Various aspects of the design and operation of a magnetically supported superconducting rotor are studied. The forces on a magnetically supported body are calculated and compared to experimentally observed values. A method is presented for calculating the magnetic field and forces on the surface of a diamagnetic body in the field of one or more axisymmetric coils. The force and field effects of a small deviation from the nominal axial symmetry are derived. The results of the field calculations are used in the equations of motion to predict the behavior of a supported superconducting spinning body. Experimental apparatus and techniques used in achieving temperatures necessary for superconductivity (4°K) are described. Details of the rotor, coils, spin-up system, and instrumentation are given. A description of the procedure used in operating the system is given. The experimental results agree quite closely to those calculated, and it is therefore concluded that the work presents reliable quantitative tools for designing magnetically supported, axially symmetric superconducting bodies to be operated in nominally axisymmetric fields. (auth)

3176 MAGNETIC BEHAVIOR AND EFFECT OF TRANSPORT CURRENT ON IT IN SUPERCONDUCTING Nb–Zr WIRE. Kō Yasukōchi (Nihon Univ., Tokyo), Takeshi Ogasawara, Nobumitsu Usui, and Shintaro Ushio. J. Phys. Soc. Japan, 19: 1649-61(Sept. 1964).

The magnetic behavior of superconducting Nb–Zr wire was studied at 4.2°K. The magnetization curve exhibits an irreversible behavior. In transverse fields the magnetization is reduced due to the transport current, but in longitudinal fields the effect of the transport current is not recognized. The results are explained by a phenomenological model for inhomogeneous type II superconductors. The model, proposed by Silcox and Rollins, was extended to consider a pinning effect of imperfections on fluxoids. The calculated magnetization curve is in good agreement with the experimental values. The effect of the transport current is qualitatively explained by introducing the

Lorentz force on fluxoids due to current into the theory. The dependence of critical current density of a short wire sample on an applied field is also calculated and compared with the experimental values. (auth)

3177 MOVING HELIUM FILM MEASUREMENTS. P. W. F. Gribbon (Saint Andrews Univ., Fife, Scot.). Nature, 203: 1372-3(Sept. 26, 1964).

It is shown that Franchetti's proposals do not resolve the discrepancy between measurements of the thickness of moving helium films and the predictions of the Franchetti theory. (D.C.W.)

3178 EFFECT OF IMPURITIES ON THE CRITICAL TEMPERATURE OF SUPERCONDUCTORS. D. M. Ginsberg (Univ. of Illinois, Urbana). Phys. Rev., 136: A1167-70(Nov. 30, 1964).

It is shown that in homogeneous, low-concentration tin and indium alloys, impurity-induced changes in the critical temperature T_c, arising from all causes other than decreased anisotropy, can be convincingly analyzed into a part due to variations in the electron mean free path and a part due to variations in the number of conduction electrons. A comparison of the latter with direct measurements of the shift in T_c produced by electrically charging tin and indium films shows excellent agreement for five of the six alloy systems considered, although the sixth system shows poorer agreement. This analysis helps to separate the effect on T_c of changes in the phonon spectrum, the electron-electron coupling constant, and the electron density of states. (auth)

3179 ULTRASONIC ATTENUATION IN SUPERCONDUCTORS CONTAINING MAGNETIC IMPURITIES. Leo P. Kadanoff and Igor I. Falko (Univ. of Illinois, Urbana). Phys. Rev., 136: A1170-80(Nov. 30, 1964).

The theory for a superconductor with magnetic impurities is applied to the calculation of attenuation coefficients. In this calculation several electronic time-dependent correlation functions are evaluated, and these functions are then used to evaluate the attenuation. In the limit of low sound-wave frequencies, the resulting coefficients are expressed in terms of a single energy integral. The physical significance of the result is discussed in terms of an effective density of "normal electrons" and energy-dependent mean free paths. Then the attenuation is evaluated in the limit of low temperatures for superconductors both with and without an energy gap. (auth)

3180 QUANTIZED VORTEX RINGS IN SUPERFLUID HELIUM. G. W. Rayfield and F. Reif (Univ. of California, Berkeley). Phys. Rev., 136: A1194-1208(Nov. 30, 1964).

Evidence is presented to show that charged particles in superfluid helium at low temperatures can be accelerated to create freely moving charge-carrying vortex rings in the liquid. The circulation of these vortex rings can be determined by measuring their energy and velocity; it is found to be equal to one quantum h/m, where h is Planck's constant and m is the mass of a helium atom. The core radius of the vortex is approximately 1 Å. The dynamical properties of such a vortex ring moving under the influence of external forces can be described by a dispersion relation $E \propto p^{\frac{1}{2}}$ connecting its energy E and momentum p; it can also be understood in detail in terms of the hydrodynamic force. Experiments are described which verify the essential validity of this dynamical analysis. Vortex rings can interact with various quasiparticles in the liquid, i.e., with rotons, phonons, and ^{3}He impurities. The scattering of these quasiparticles by vortex rings can be investigated by experiments designed to study the temperature dependence of the rate of energy loss of such rings moving through the liquid. In this way it is possible to measure the effective momentum-transfer cross sections for scattering of the various quasiparticles by vortex lines. The cross section thus deduced is 9.5 Å for scattering of rotons and 18.3 Å for scattering of ^{3}He atoms. The experiments yield only scant information about scattering of phonons, but are not inconsistent with the magnitude of the phonon scattering cross section expected on theoretical grounds. (auth)

3181 MILLIMETER-MICROWAVE STUDIES OF ENERGY-GAP ANISOTROPY IN SUPERCONDUCTORS. Manfred A. Biondi, M. P. Garfunkel, and Wm. A. Thompson (Univ. of Pittsburgh). Phys. Rev., 136: A1471-80 (Dec. 14, 1964).

Measurements of the absorption of polarized microwaves were made on superconducting single crystals of aluminum and zinc as a function of frequency in the region where the photon energy spans the superconducting energy gap. When plotted as isotherms of surface resistance ratio versus photon energy the results for aluminum show, in three different crystal faces (100, 110, and 111), two rapid changes in slope occurring at values of energy about 10% apart. The photon energies at these slope changes are interpreted as indicating the positions of two different superconducting energy gaps. Small differences are found in the energy-gap values (~3%) among the three different crystal faces. All the measured values of energy gaps at $T = 0$ in aluminum lie between $3.04kT_c$ and $3.50kT_c$, where $T_c = 1.175°K$. Preliminary results on a single crystal of zinc yield an energy gap at $T = 0$ of $(3.00 \pm 0.15)\ kT_c$, where $T_c = 0.838°K$. (auth)

3182 THERMAL TRANSPORT COEFFICIENTS OF A SUPERCONDUCTOR. J. M. Luttinger (Columbia Univ., New York). Phys. Rev., 136: A1481-5(Dec. 14, 1964).

The phenomenological equations of a superconductor in the presence of temperature gradients are discussed. From these, an expression for the thermal conductivity as a correlation function of the Kubo type is given. (auth)

3183 FREE-ENERGY DIFFERENCE BETWEEN NORMAL AND SUPERCONDUCTING STATES. John Bardeen and Michael Stephen (Yale Univ., New Haven). Phys. Rev., 136: A1485-7(Dec. 14, 1964).

The Eliashberg expression for the free-energy difference between superconducting and normal states for an electron-phonon interaction model is evaluated so as to estimate the errors involved in expressions based on the weak-coupling limit. It is shown that the major correction comes from the difference in self-energy terms Σ_{1s} and Σ_{1n} and is relatively of order $[(\Delta/\omega_0)\ \ln\ (\Delta/\omega_0)]^2$, where ω_0 is an average phonon energy. The correction may be appreciable for strong-coupling superconductors such as lead. (auth)

3184 SCATTERING OF SOUND BY A CLASSICAL VORTEX. Alexander L. Fetter (Univ. of California, Berkeley). Phys. Rev., 136: A1488-93(Dec. 14, 1964).

The cross section for the scattering of sound by a vortex is calculated using the linearized equations of classical hydrodynamics. With a circulation κ, the differential cross section in the long-wavelength limit is $\frac{1}{2}\pi(\kappa/2\pi c)^2 k \sin^2 \varphi (1-\cos\varphi)^{-2}$, where c is the speed of sound. Possible experimental verification is suggested, with particular reference to liquid He II. (auth)

3185 THIRD SOUND IN LIQUID HELIUM FILMS. C. W. F. Everitt, K. R. Atkins, and A. Denenstein (Univ. of Pennsylvania, Philadelphia). Phys. Rev., 136: A1494-9 (Dec. 14, 1964).

The existence of third sound, a surface wave on thin film films of superfluid helium, was demonstrated experimentally. The velocity and attenuation of the waves were measured as functions of excitation frequency, film thickness, and temperature. In the main, the results agree with earlier predictions and yield new information about the forces which cause the formation of helium films. Preliminary measurements on third sound in moving films and on surface-tension ripples on bulk liquid helium are also described. (auth)

3186 PROPERTIES OF SUPERCONDUCTING ALLOYS CONTAINING PARAMAGNETIC IMPURITIES. S. Skalski, O. Betbeder-Matibet, and P. R. Weiss (Rutgers Univ., New Brunswick, N. J.). Phys. Rev., 136: A1500-18 (Dec. 14, 1964).

Calculations were made on the effects of paramagnetic impurities in superconductors, using the Abrikosov-Gor'kov theory as the starting point and taking full advantage of the information contained in the Green's function of the system. The density of states in energy was computed for different values of the inverse collision time for exchange scattering Γ. The (half) excitation energy gap

Ω_G (as distinguished from the order parameter Δ) is defined to be the energy at which the density of states vanishes. The temperature-dependent order parameter was computed for different values of Γ, and from this, the behavior of Ω_G (T) is determined. A comparison with tunneling experiments shows a disagreement of about 30%. The thermodynamic properties of the system follow from the density of states; the critical field and the discontinuity in the specific heat at the critical temperature are calculated in considerable detail. Expressions for the penetration depth and complex conductivity are obtained, and numerical results are presented for the case T = 0°. The real part of the conductivity at T = 0° is shown to be zero for frequencies less than $2\Omega_G$ and proportional to the square of the density of states for vanishingly small frequencies in the gapless region of impurity concentrations. (auth)

3187 EVALUATION OF HIGH-FREQUENCY ULTRASONIC ATTENUATION IN SUPERCONDUCTORS IN THE BARDEEN-COOPER-SCHRIEFFER THEORY OF SUPERCONDUCTIVITY. V. M. Bobetic (Univ. of Illinois, Urbana). Phys. Rev., 136: A1535-8(Dec. 14, 1964).

Calculations are given of the ratio of the attenuations of longitudinal sound waves in the superconducting and normal states according to the BCS theory of superconductivity for an isotropic model at arbitrary frequencies and temperatures. It is predicted that there is a discontinuity in attenuation at a frequency corresponding to the energy gap. (auth)

3188 THEORY OF INTERACTING FERMI SYSTEMS. P. Nozières, ed. Frontiers in Physics. A Lecture Note and Reprint Series. New York, W. A. Benjamin, Inc., 1964. 378p. $13.50.

Theory for both normal and superfluid Fermi liquids is presented, including Landau theory, Green's function formalism, and perturbation techniques. (D.C.W.)

Neutron Physics

3189 (CRRP-1201) ON THE SOLUTION OF THE INTEGRAL BOLTZMANN EQUATION IN CYLINDRICAL GEOMETRY. D. C. Sahni (Atomic Energy of Canada Ltd., Chalk River, Ont.). Sept. 1964. 29p. (AECL-2083). Dep.; $1.50(AECL).

The solution of the steady-state integral Boltzmann equation for the neutron flux is considered in a two region cylindrically symmetric system. The inner region is a scattering and absorbing medium, which may also contain isotropic sources. The outer region is purely scattering, and is source-free except for a total net current of neutrons at infinity. A method for solving this equation is discussed. In particular it is shown that a solution exists only for one value of a parameter, the "extrapolation distance," which also satisfies the requirement of neutron conservation. Exact numerical determination of the extrapolation distance and flux are carried out in the particular case when the total cross sections of two media are equal. Some applications to the finite medium problem (i.e. the cell problem) have also been considered in this special case. (auth)

3190 (NAA-SR-Memo-9891) ULCER—A ONE-DIMENSIONAL, MULTIGROUP DIFFUSION EQUATION CODE WITH UPSCATTER. D. S. Vargofcak, W. T. Hayes, and D. W. Roeder (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). May 1964. Contract AT-11-1-GEN-8. 148p. Dep.(mn); $4.00(cy), 3(mn) OTS.

ULCER is an IBM 7090 FORTRAN program for solving the one-dimensional, multigroup diffusion equation with upscatter, an outgrowth of the AIM, FAIM, and FOG codes. Up to 40 groups are allowed with downscatter through 39 and upscatter through 32. Twelve regions are allowed with up to twelve elements per region and a total of 101 space points. Microscopic cross sections are on tape with modification allowed at execution time. Searches and multiple boundary conditions are available as in FAIM. An additional feature is multiple source spectra. Modifications made to the original version of ULCER are described. (auth)

3191 (RPI-328-16) LINEAR ACCELERATOR PROJECT PROGRESS REPORT, JULY–SEPTEMBER 1964. E. R. Gaerttner (Rensselaer Polytechnic Inst., Troy, N. Y.). Contract AT(30-3)-328. 48p. Dep.(mn); $2.00(cy), 1(mn) OTS.

Information is summarized on: time-dependent neutron spectra in D_2O; extrapolated endpoint for pulsed neutron calculations in the P-N multigroup approximation; theory and applications of low-energy neutron inelastic scattering; neutron spectra; neutron resonance parameters for hafnium isotopes; neutron capture measurements for tungsten isotopes; measurements of capture-to-fission ratio for ^{235}U; spatially dependent asymptotic neutron spectra in pure moderators; effects of coherent scattering on the thermalization of neutrons in Be; multiplying medium spectrum measurements; relation between diffusion cooling coefficient and asymptotic neutron spectrum temperature; and low-energy neutron inelastic scattering by the chopper method. (R.E.U.)

3192 THE RELAXATION OF A NEUTRON PULSE IN A HEAVY MEDIUM. L. M. Grossman, P. L. Chambré, and J. P. Geffroy (Univ. of California, Berkeley). Energia Nucl. (Milan), 11: 593-8(Nov. 1964).

The decay in time and energy of an instantaneous burst of monoenergetic neutrons in a heavy medium of infinite extent is obtained as the Green's function solution to a Fokker–Planck partial differential equation for a particular choice of the energy dispersion relation. The solution is obtained in closed form in terms of elementary functions, permitting a complete description of the pulse history. The solution form is adjusted to the heavy-gas model by a modification of the definition of the time scale which gives an average adjustment to the heavy-gas slowing-down density and the same lowest eigenvalue controlling the approach to equilibrium. The results are compared with series-expansion solutions to the heavy-gas pulse decay problem. (auth)

3193 THE SECOND SPATIAL MOMENT OF NEUTRON DISTRIBUTION IN HYDROGENOUS MODERATORS CONTAINING VOIDS. Tamotsu Sekiya (Osaka Univ.), Tokuo Suita, and Hirokazu Murase. J. Nucl. Sci. Technol. (Tokyo), 1: 236-41(Oct. 1964).

Assuming that neutron energy decrement in collisions with oxygen nuclei is negligibly small compared with that in collisions with hydrogen nuclei, and that elastic scatterings by hydrogen nuclei are isotropic in the center of the mass system, the stochastic method to calculate the second spatial moment of neutron distribution in a homogeneous medium, already reported, is generalized to cases of random distribution of the same voids in hydrogenous moderators. In general, the distribution law of free path length in such a system deviates from the exponential rule. The result for the migration area becomes the sum of two terms of an average exponential distribution and of the mean square deviation therefrom peculiar to the heterogeneous system. This mean square deviation may be calculated by one-group theories, each factor of this deviation being expressed as a sum of terms at each energy, and the approximations contained in their theories being rather good in isotropic systems. Thus it was concluded that one-group treatments reported by others may be generalized into multi-group problems without any approximation being added. The numerical results show that the ratio of heterogeneous to homogeneous terms has a maximum at a void ratio which varies with the radius of the spheres, and the oblate deformation of spherical voids has no vital effect. (auth)

3194 THERMAL NEUTRON SPECTRA IN PLANE GEOMETRY FOR LIGHT WATER. Edgar Kiefhaber (Kernforschungszentrums, Karlsruhe, Ger.). Nukleonik, 6: 262-6(Sept. 1964). (In German)

Experiments with pulsed arrangements showed that the periodic asymptotic energy distribution of neutrons on the

boundary and in the middle of a medium differ from one another because of the diffusion cooling effect. As a first step for theoretical investigation of this problem, the energy-dependent Milne problem was treated. For light water used as the scattering medium, the differential cross section of M. S. Nelkin was used. The good agreement of the obtained results for the spectrum at the boundary of the semi-infinite body with the measured emission spectrum from a large geometry allowed the periodic asymptotic energy distribution of neutrons for pulsed experiments to be investigated theoretically in finite plates. For all calculated cases (plate thicknesses $\geqq 2$ cm) an excellent agreement between theory and experiment was obtained. Both the emission spectra and the spectra in the middle of the plates showed plainly the influence of the diffusion cooling effect. (tr-auth)

3195 AN EXPLICIT SOLUTION OF THE ONE VELOCITY MULTI-DIMENSIONAL BOLTZMANN-EQUATION IN P_N APPROXIMATION. K. M. Dede (Inst. for Experimental Physics, Debrecen, Hungary). Nukleonik, 6: 267-71 (Sept. 1964).

Explicit formulas were derived for the moments of spherical harmonic approximation of the one-velocity multi-dimensional Boltzmann equation. The so-called complementary functions were treated on an equal footing with the functions arising from the derivatives of scalar flux, and they are given directly without supplementary conditions. The transformation of general formulas into special geometry is illustrated by the example of a finite cylinder. (auth)

3196 ANALYTICAL REPRESENTATION OF NEUTRON FLUX IN PLATE-LAYERS. Karl-Heinz Mueller (CCR-EURATOM, Ispra, Italy). Nukleonik, 6: 271-4(Sept. 1964). (In German)

The direct method of variation calculation, applied to the Boltzmann equation for neutron transport, allowed the construction of analytical expressions, by means of which the neutron distribution in the reactor could be described in clearly arranged ways. For the one-dimensional plate layers, three useful ways for the solution of shielding questions are shown and performed. (tr-auth)

3197 CRITICALITY OF A PLATE. Johann Hejtmanek (Osterreichischen Hochschule, Vienna). Nukleonik, 6: 274-5(Sept. 1964). (In German)

A criticality condition of the energy-independent transport problem for plane geometry is given. (M.C.G.)

3198 A LOW COST NEUTRON FACILITY FOR DOSIMETRY STUDIES. D. E. Watt, R. C. Lawson, and J. Williamson (United Kingdom Atomic Energy Authority, Chapelcross, Annan, Scotland). Phys. Med. Biol., 9: 477-85(Oct. 1964).

A neutron irradiation facility which is suitable for neutron dosimetry studies has been constructed from a 10 curie Pu-Be source shielded by polytene, boron, and lead mixtures. This type of installation supplies collimated beams of fast neutrons with a negligible γ-ray content. An experimental assessment is made of the beam profile on leaving the collimator and of the contribution from scattered and leakage neutrons to the spectrum. (auth)

3199 COHERENT INELASTIC SCATTERING OF SLOW NEUTRONS BY A POLYATOMIC LIQUID ELEMENT. M. Antonini, P. Ascarelli, and G. Caglioti (CCR-EURATOM, Ispra, Italy). Phys. Rev., 136: A1280-5(Nov. 30, 1964).

An expression for the coherent inelastic-scattering cross section of slow neutrons by a diatomic liquid element has been determined by extending Vineyard's approximation to systems with internal degrees of freedom. The range of validity of the expression obtained has been discussed, taking into account also the energy resolution of the experimental setup. The energy spectrum of neutrons scattered by a sample of liquid bromine has been measured with a triple-axis spectrometer for a fixed value of the modulus of the momentum exchange. Reasonable experimental evidence for the existence of a peak associated with the excitation of the first vibrational level in liquid bromine was obtained in the neighborhood of an energy transfer $\hbar\omega = 0.04$ ev; this is approximately the value established by measurements of conventional spectroscopy in the gaseous phase. (auth)

3200 SLOW-NEUTRON INELASTIC SCATTERING FROM BERYLLIUM POWDER. R. E. Schmunk (Phillips Petroleum Co., Idaho Falls, Idaho). Phys. Rev., 136: A1303-11(Nov. 30, 1964).

The inelastic scattering of slow neutrons by a sample of beryllium powder has been measured using the Materials Testing Reactor phased-chopper velocity selector. Data were obtained at incident neutron energies of 0.040, 0.0415, 0.070, and 0.10 ev and at room temperature for a sample which had a transmission of 87%. The data were converted to partial differential cross sections and to the scattering-law presentation $S(\kappa,\hbar\omega)$. In contrast to previous measurements, the scattering-law presentation of the data displays considerable structure which correlates directly with the interference condition for coherent scattering. Factors that contribute to the observed structure include the structure factor for neutron-phonon interactions and the phonon dispersion relation itself. Data from this experiment are compared with the dispersion relation for single-crystal beryllium and the calculated frequency distribution of beryllium. (auth)

3201 POSITION- AND ANGULAR-DEPENDENT SPECTRUM MEASUREMENTS IN H_2O. J. M. Neill, J. C. Young, and W. Brouwer (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 227-(Nov. 1964).

3202 NEUTRON-SPECTRUM MEASUREMENTS IN D_2O. J. C. Young, J. M. Neill, and W. Brouwer (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 227-8(Nov. 1964).

3203 NEUTRON SPECTRA AT A POISON AND TEMPERATURE DISCONTINUITY IN GRAPHITE. R. C. Bardes, J. M. Neill and G. K. Houghton (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 228-9(Nov. 1964).

3204 THE DEMONSTRATION OF THERMALIZATION EFFECTS BY THE REFLECTION OF NEUTRON WAVES. R. S. Denning, R. S. Booth, and R. B. Perez (Univ. of Florida, Gainesville). Trans. Am. Nucl. Soc., 7: 229-30 (Nov. 1964).

3205 SPECTRAL CORRELATION ANALYSIS OF PULSED-NEUTRON DECAY DATA. J. A. De Juren (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 230-1(Nov. 1964).

3206 A RELATION BETWEEN THE DIFFUSION COOLING COEFFICIENT AND THE ASYMPTOTIC NEUTRON SPECTRUM TEMPERATURE. R. R. Fullwood (Rensselaer Polytechnic Inst., Troy, N. Y.). Trans. Am. Nucl. Soc., 7: 231-2(Nov. 1964).

3207 TEMPERATURE DEPENDENCE OF THE THERMAL NEUTRON PROPERTIES OF D_2O. J. W. Daughtry and A. W. Waltner (North Carolina State Coll., Raleigh). Trans. Am. Nucl. Soc., 7: 232-3(Nov. 1964).

3208 INTERFACE CONDITIONS AND NUMERICAL TECHNIQUES. Ward Sangren (Computer Applications Inc., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 234 (Nov. 1964).

3209 AN ITERATIVE SOLUTION METHOD FOR THE NEUTRON TRANSPORT EQUATION WITH ANISOTROPIC SCATTERING. Bruce W. Crawford and Paul L. Chambre (Univ. of California, Berkeley). Trans. Am. Nucl. Soc., 7: 254-5(Nov. 1964).

3210 MODIFIED SPHERICAL HARMONIC APPROXIMATIONS. T. E. Dudley (Knolls Atomic Power Lab., Schenectady, N. Y.) and P. B. Daitch. Trans. Am. Nucl. Soc., 7: 262-3(Nov. 1964). (RPI-328-10)

3211 CALCULATIONAL METHODS FOR ANGULAR DISTRIBUTIONS IN SLABS. J. Certaine (United Nuclear Corp., White Plains, N. Y.) and L. Lois. Trans. Am. Nucl. Soc., 7: 263(Nov. 1964).

3212 HALF-SPACE NEUTRON TRANSPORT WITH LINEARLY ANISOTROPIC SCATTERING. G. C. Summer-

field, N. J. McCormick, and I. Kuščer (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc., 7: 264(Nov. 1964).

3213 A CALCULATION OF THE DISADVANTAGE FACTOR IN CYLINDRICAL GEOMETRY. Alan H. Robinson and Joel H. Ferziger (Stanford Univ., Calif.). Trans. Am. Nucl. Soc., 7: 264-5(Nov. 1964).

3214 RESONANCE ABSORPTION IN PARTICLES. R. A. Lewis and T. J. Connolly (Stanford Univ., Calif.). Trans. Am. Nucl. Soc., 7: 274-5(Nov. 1964).

3215 ABSORPTION IN LOW-ENERGY RESONANCES. M. A. Robkin and Rubin Goldstein (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 7: 276-7 (Nov. 1964).

3216 THE PROPAGATION OF NEUTRON BURSTS AND THE DETERMINATION OF THE SYSTEM DISPERSION LAW. M. N. Moore (San Fernando Valley State Coll., Northridge, Calif.). Trans. Am. Nucl. Soc., 7: 278-9(Nov. 1964).

3217 THE USE OF CORRELATED SAMPLING IN MONTE CARLO CALCULATION OF CHANGES IN THERMAL ABSORPTION. N. J. Curlee, Jr. and L. A. Ondis, II (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 288-9(Nov. 1964).

3218 A METHOD OF AVERAGING DIFFUSION COEFFICIENTS. P. A. Ombrellaro and P. J. von Herrmann (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nucl. Soc., 7: 291-2(Nov. 1964).

3219 AMERICIUM–BERYLLIUM–CADMIUM [CURIUM] NEUTRON SOURCES. E. H. Acree (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 348-9 (Nov. 1964).

3220 MEASUREMENTS AND CALCULATIONS OF NEUTRON TRANSMISSION THROUGH LITHIUM HYDRIDE. F. H. S. Clark, F. B. K. Kam, and F. J. Muckenthaler (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 354(Nov. 1964).

3221 FEW-GROUP AND MULTIGROUP CALCULATIONS OF NEUTRON PENETRATION. K. Shure (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 355-6(Nov. 1964).

3222 A COMPARISON OF FIRST- AND LAST-FLIGHT EXPECTATION VALUES USED IN AN O5R MONTE CARLO CALCULATION OF THE NEUTRON DISTRIBUTION IN WATER. D. K. Trubey and M. B. Emmett (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 357-8(Nov. 1964).

3223 FAST-NEUTRON TRANSPORT IN WATER. M. S. Bokhari and V. V. Verbinski (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 370(Nov. 1964).

3224 FABRICATION OF AMERICIUM–BERYLLIUM NEUTRON SOURCES USING A SYSTEM TO PREVENT CAPSULE CONTAMINATION. W. C. Mohr and J. VanLoon (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 479(Nov. 1964).

3225 SOME NUCLEAR CODES DEVELOPED AT THE COMPUTING CENTER OF ISPRA. I. Galligani, C. Mongini Tamagnini, and C. Ponti (Euratom, Ispra, Italy). Trans. Am. Nucl. Soc., 7: 515-16(Nov. 1964).

3226 INSTANCES OF STANDARDS PREPARATION AND NEUTRON DATA DETERMINATION AT EURATOM'S CENTRAL BUREAU OF NUCLEAR MEASUREMENTS. J. Spaepen (Euratom, Geel, Belg.). Trans. Am. Nucl. Soc., 7: 516-17(Nov. 1964).

3227 NEUTRON PHYSICS. K. H. Beckurts and K. Wirtz. Completely Revised Edition of "Elementare Neutronenphysik" Published in 1958 in German. Translated by L. Dresner. Berlin, Springer-Verlag, 1964. 454p. DM68.–.

A survey is presented of: the physical properties of the neutron, neutron sources and detectors, and cross-section measurements; the theory of neutron fields; the theory of diffusion, slowing-down, and thermalization; the determination of neutron fluxes and distributions; and the determination of neutron transport properties. (T.F.H.)

3228 NEUTRON CONVERTER. Rex L. Callaway (to Lockheed Aircraft Corp.). U. S. Patent 3,157,790. Nov. 17, 1964. Filed Feb. 20, 1962.

A neutron converter for producing, inexpensively, a high flux or a monoenergetic source is offered. The L-shaped arrangement consists of a hydrogenous moderator-filled column at right angles to an air-filled column containing the object to be irradiated. The reaction target is at the juncture of the columns. The hydrogenous column moderates the neutrons which react with the target to produce 14-Mev neutrons with a LiD target. (T.R.H.)

Nuclear Properties and Reactions

Refer also to abstract 3110.

3229 (AE-158) A STUDY OF THE ANGULAR DISTRIBUTIONS OF NEUTRONS FROM THE $Be^9(p,n)B^9$ REACTION AT LOW PROTON ENERGIES. B. Antolkovic, B. Holmqvist, and T. Wiedling (Aktiebolaget Atomenergi, Stockholm). 1964. 19p. Dep.(mn).

The angular distributions of neutrons from the reaction $^9Be(p,n)^9B$ were studied at 2.300, 2.335, 2.389, and 2.560 Mev; time-of-flight techniques were used. The angular distribution measurements show remarkable differences compared to earlier published results using long-counters as detectors. The new results are ascribed to the different experimental methods. By using time-of-flight techniques it was possible to eliminate disturbing influences from neutrons obtained from the $^9Be(p,p'n)^8Be$ reaction, which has a lower reaction threshold than the $^9Be(p,n)^9B$ reaction, as well as other Be-p reactions emitting neutrons. The experimental distribution at 2.30 Mev was compared with the simplified theories for direct interaction processes developed by Satchler and Rodberg. It is shown that Rodberg's proposal of using optical model wave functions describes the experiment better than Satchler's original theory. However, a good fitting leads to a nuclear radius as well as an optical potential which is appreciably smaller than ordinarily obtained in scattering experiments. (auth)

3230 (AE-160) MEASUREMENTS OF THE $Fe^{54}(n,p)Mn^{54}$ REACTION CROSS SECTION IN THE NEUTRON ENERGY RANGE 2.3–3.8 Mev. A. Lauber and S. Malmskog (Aktiebolaget Atomenergi, Stockholm). Oct. 1964. 13p. Dep.(mn).

The cross section for the reaction $^{54}Fe(n,p)^{54}Mn$ was measured using a surface barrier detector to record the number of protons released in the reaction. The neutron flux was determined by means of a hydrogenous radiator, detecting the scattered protons with the solid state detector, and calculating the number of impinging neutrons from the well known n-p scattering cross section. The $^{54}Fe(n,p)^{54}Mn$ reaction cross section is found to increase from 25 mb at 2.3 Mev to 208 mb at 3.5 Mev. (auth)

3231 (ANL-5772) INTERVAL DISTRIBUTION IN CORRELATED (PARENT-DAUGHTER) DECAY. ESTIMATION OF DAUGHTER HALF-LIFE. John A. Crawford (Argonne National Lab., Ill.). Aug. 1964. Contract W-31-109-eng-38. 13p. Dep.; $1.00(OTS).

An electronic circuit known as an interval selector is used in conjunction with an ionization chamber to count the number of intervals between successive ionizing alpha particles smaller than a given time τ, which can be varied from 3×10^{-5} sec to approximately 0.2 sec. The paper gives the theory of the counting rate of the interval selector when the sample used contains a very short-lived parent-daughter combination. An experimental procedure is then given for the measurement of this short lifetime in terms of counting rates obtained on the interval selector. (auth)

3232 (BNL-8527) THE LEVEL STRUCTURE OF He^4. Paul F. Donovan (Brookhaven National Lab., Upton, N. Y.). [nd]. Contract AT-30-2-GEN-16. 11p. (CONF-811-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From 9th Yugoslavian Summer Meeting of Physicists, Hercegnoui, Yugoslavia, July 1964.

A 31.5-Mev ^{3}He cyclotron beam was used to study possible energy levels in ^{4}He by means of the reaction $^3He + d \rightarrow p + {}^{4*}He$; coincidences between particles populating levels in ^{4}He and breakup particles from the decay of these levels were studied. (R.E.U.)

3233 (JINR-D-1818) SINTEZ I FIZICHESKAYA IDENTIFIKATSIYA IZOTOPA 104-GO ELEMENTA S MASSOVYM CHISOLM 260. (Synthesis and Physical Identification of the Isotope of 104 Element With a Mass Number of 260). G. N. Flerov, Yu. Ts. Oganesyan, Yu. V. Lobanov, V. I. Kuznetsov, V. A. Druin, V. P. Perelygin, K. A. Gavrilov, S. P. Tret'yakova, and V. M. Plotko (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Reactions). 1964. 9p. Dep.(mn).

Element-104 was synthesized in the reaction $^{242}Pu(^{22}Ne,4n)$ using a cyclotron beam. It was found that $^{260}104$ decays by spontaneous fission with a half life of 0.3 sec. (R.V.J.)

3234 (JINR-P-1744) ASIMPTOTICHESKIE SVOISTVA NEKOTORYKH MODEL'NYKH GAMIL'TONIANOV V YADERNOI FIZIKE. I. ODNOCHASTICHNYE VOZBUZHDENIYA. (Asymptotic Properties of Some Hamiltonians Encountered in Nuclear Physics. I. One-Particle Excitations). E. Chervonko (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics). 1964. 15p. Dep.(mn).

The asymptotic properties of the mean value of energy and of single-particle excitations of model hamiltonians at finite temperature are investigated. The case when the number of particles is tending to infinity is considered. In the model second-quantized hamiltonian, the number of summations over the single-particle degrees of freedom is less by unity if compared with that in the real case. The paper is a continuation of the well-known papers by Bogolubov and co-workers on the asymptotic properties of the model hamiltonian in the theory of superconductivity. (auth)

3235 (JINR-P-1761) SECHENIE DELENIYA U-235 DLYA NEITRONOV REZONANSNYKH ENERGII. (Fission Cross Section of U^{235} for Neutrons of Resonance Energies). Shih-ti Wang, Yung-ch'ang Wang, E. Dermendzhiev, and Yu. V. Ryabov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Neutron Physics). 1964. 11p. Dep.(mn).

The ^{235}U resonances were investigated using a pulsed fast-neutron reactor and time-of-flight facility for energies of 2 to 70 ev. A liquid scintillation detector was used. The resolution was 0.04 μsec/m. The energy behavior of the fission cross sections $\sigma_f \sqrt{E}$ was obtained. Using the "area" method the values of $\sigma_0 \Gamma_f$ were found for 55 levels. (auth)

3236 (JINR-P-1765) SPEKTRY NEITRONOV PRI VZAIMODEISTVII TYAZHELYKH IONOV S YADRAMI SREDNEGO VESA. (Neutron Spectra in Heavy Ion Interaction With Medium Nuclei). G. Kumpf, L. Kumpf, and Shuang-ui Shih (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Reactions). 1964. 11p. Dep.(mn).

The neutron spectra were measured by bombarding Fe, Cu, Mo, Rh, and Sn targets with ^{40}Ar, ^{22}Ne, and ^{11}B projectiles. The time-of-flight method was used; the natural modulation of the Y-300 cyclotron beam being made use of. In the energy region (5 to 22 Mev) available for measurements all the spectra have the shape exp (-E/T); the parameter T varies within 1.5 to 2.5 Mev. It is concluded that about 40 Mev of the excitation energies of compound nuclei obtained in bombarding ^{40}Ar with the projectiles is carried away by γ-radiation. (auth)

3237 (JINR-P-1767) O π-MEZOATOMIYKH PROTSESSAKH V VODORODOSODERZHASHCHIKH VESHCHESTVAKH. (On π^--Mesoatomic Processes in Hydrogenous Substances). V. I. Petrukhin and Yu. D. Prokoshkin (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1964. 4p. Dep.(mn).

The capture of negative pions by protons in hydrogenous substances (gases and solutions) was investigated. It is shown that the pion transfer from hydrogen to heavier atoms has a local character. (auth)

3238 (JINR-P-1771) NEITRONNYE REZONANSY NIOBIYA I RUBIDIYA I PADIATSIONNYE SHIRINY SREDNIKH YADER. (Niobium and Rubidium Neutron Resonances and Radiation Widths of Medium Nuclei). E. I. Sharapov, L. B. Pikel'ner, N. I. Liesku, Hi Sang Kim, and Kh. Sirazhet (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Neutron Physics). 1964. 14p. Dep.(mn).

The neutron resonance parameters for niobium and rubidium in the energy range up to 400 ev and up to 1300 ev, respectively, were determined by measuring the transmission, capture, and scattering. The values obtained for the radiation widths for niobium s- and p-wave levels coincide within the measurement error. The radiation width for the magic nucleus of rubidium-87 is less than that for the nonmagic rubidium-85. The experimental data on the radiation widths of medium nuclei show a minimum in the region of the closed shell with the number of neutrons equal to 50. (auth)

3239 (MIT-2098-67) PHYSICAL BASIS OF THE OPTICAL MODEL. R. H. Lemmer (Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science). Aug. 1964. Contract AT(30-1)-2098. 11p. (CONF-682-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Gordon Conference on Nuclear Structure Physics, New London, N. H., Aug.-Sept. 1964.

Some physical characteristics of the optical model for nucleon–nucleon and more complex reactions are discussed. Information obtainable about nuclear dynamics from the empirical optical potential is discussed. (R.E.U.)

3240 (ORNL-P-169) GAMMA-RAY BRANCHINGS IN THE DECAY OF ^{116}In, ^{141}Ce, AND ^{147}Nd. James S. Eldridge, Peter Crowther, and William S. Lyon, Jr. (Oak Ridge National Lab., Tenn.). [1958]. Contract W/7405-eng-26. 3p. (CONF-654-16). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

Source preparation, β-γ coincidence techniques, and results are described. (R.E.U.)

3241 (PAN-515/I) INVESTIGATION OF THE NUCLEAR SURFACE BY MEANS OF THE $La^{139}/n, \alpha/Cs^{136}$ REACTION. W. Osakiewicz, J. Turkiewicz, Z. Wilhelmi, and M. Jaskóva (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Mar. 1964. 10p. Dep.

Application of the (n,α) reactions as a tool for the investigation of the nuclear surface is proposed. Conclusions are drawn on the probability of finding alpha substructures at the surface of ^{139}La. (auth)

3242 (PAN-517/I) DOSWIADCZALNA FIZYKA JADRA ATOMU W OSRODKU WARSZAWSKIM W LATACH 1945-63. (Experimental Physics of Atomic Nucleus in Warsaw, 1945-63). Z. Wilhelmi (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). Apr. 1964. 38p. Dep.

Low-energy nuclear physics research at Warsaw University is reviewed. A list of 119 papers published from 1950 to 1963 is included. (R.E.U.)

3243 (RFR-239) INELASTIC SCATTERING AND GAMMA RADIATION FROM COPPER. H. Haeggblom (Aktiebolaget Atomenergi, Studsvik, Sweden). Aug. 14, 1963. 15p. Dep.(mn).

Inelastic cross sections are calculated for ^{65}Cu in the energy region 0.8 to 1.75 Mev. The angular dependence of the gamma radiation from inelastic scattering in ^{63}Cu and ^{65}Cu is given for primary neutron energies 1.0, 1.25, and 1.5 Mev. (auth)

3244 NOTE ON THE CONNECTION BETWEEN RELAXATION TIME AND TRANSITION PROBABILITY. Herbert Malamud (Republic Aviation Corp., Farmingdale, N. Y.). Am. J. Phys., 32: 892(Nov. 1964).

The relation between the transition probability/unit time for the spontaneous transition of a particle from an upper a lower energy state and the relaxation time of a system of such particles is derived. (D.C.W.)

3245 ON THE THEORY OF ASYMMETRIC FISSION OF NUCLEI. S. G. Ryzhjanov. Analelé Stiint. Univ. A. I. Cuza, Iasi, Sect. I, 9: 487-92(1963). (In Russian)

After a discussion of the critical observations on different asymmetric fission models for heavy nuclei, it was concluded that the mechanisms of the asymmetry of spontaneous and induced fission are different. For the latter case, the theory of Whetstone was maintained; in the case of spontaneous fission, the empirical data favored the Frenkel mechanism, which attributes the passage of the fission products by the potential barrier to the tunnel effect. (tr-auth)

3246 ANALYSIS OF NUCLEON-NUCLEUS SCATTERING. A. H. Cromer (Northeastern Univ., Boston) and J. N. Palmieri. Ann. Phys. (N. Y.), 30: 32-50(Oct. 20, 1964).

The small angle scattering amplitudes of 140-Mev nucleons elastically scattered from He, Be, C, and Al were determined by making a least squares fit to some of the available proton and neutron cross section and polarization data. The nuclear amplitudes were parameterized as in the earlier work of Cromer and (in the case of p-nucleus scattering) were combined with the Coulomb amplitudes following the work of Bethe. The analysis was restricted to the angular region from 3 to 11° and resulted in the determination of the real and imaginary parts of the spin-independent and spin-dependent amplitudes at zero degrees. All the p-nucleus data at angles <6° were corrected for multiple Coulomb scattering, following the work of Cormack. These corrections were very large (e.g., the correction was 35% for carbon at 4° lab.) and were found to be necessary in order to obtain simultaneous fits to the proton and neutron data. The high energy scattering approximation was then used to determine the central and spin-orbit optical parameters from these amplitudes. In impulse approximation these optical parameters are related directly to the nucleon-nucleon scattering amplitudes: $\mathscr{A} = \frac{3}{4}A_1(0) = \frac{1}{4}A_0(0)$ and $\mathscr{C} = [(\frac{3}{4}C_1(\theta) + \frac{1}{4}C_0(\theta))/\sin\theta]_{\theta=0}$. (The subscripts 1 and 0 refer to the isotopic spin states of the two-nucleon system.) In this way $\mathscr{A}$ and $\mathscr{C}$ were determined from the scattering amplitudes for each nucleus. The results are found to be approximately independent of the particular nucleus, as they should be. Good agreement is found when the results are compared with the values of $\mathscr{A}$ and $\mathscr{C}$ obtained from the nucleon-nucleon phase shifts of Perring, except in the case of the imaginary part of $\mathscr{A}$ for which a large discrepancy appears. (C.E.S.)

3247 SOME ASPECTS OF SHORT-RANGE CORRELATIONS IN NUCLEI. J. da Providencia and C. M. Shakin (Universitet, Copenhagen). Ann. Phys. (N. Y.), 30: 95-118 (Oct. 20, 1964).

Short-range correlations are introduced into the nuclear wave function using a unitary operator whose form was originally suggested by Villars. The modification of electric-dipole transition rates as calculated in the shell model is discussed and is found to be small for the correlation assumed. Further, the effective interaction to be used for shell-model calculations is considered in the context of this theory and specific suggestions as to the nature of this interaction are put forth. Finally, it is shown how a modified Hartree-Fock procedure can be constructed for a finite system having short-range correlations. (auth)

3248 NUCLEAR ENERGY. WHAT IT IS AND HOW IT ACTS. PART 18. THE LIQUID-DROP MODEL OF THE ATOMIC NUCLEUS; SURFACE FORCES AND DENSITY OF NUCLEI; EQUILIBRIUM OF NUCLEAR FORCES; PRELIMINARY ASPECTS OF FISSION AND FUSION. Andrew W. Kramer, ed. Atomics, 17: No. 6, 50-5(Nov.-Dec. 1964).

The liquid-drop model is discussed with consideration of surface forces and nuclear density, equilibrium of nuclear forces, fission, and fusion. (D.C.W.)

3249 PHOTONEUTRON ANGULAR DISTRIBUTIONS FROM LEAD AND BISMUTH. F. R. Allum, T. W. Quirk, and B. M. Spicer (Univ. of Melbourne). Australian J. Phys., 17: 420-1(Sept. 1964).

The angular distributions of photoneutrons from Bi and Pb exposed to 17.5-Mev bremsstrahlung were measured and were fitted by a least-squares method. No asymmetry of the distributions about 90° was observed, in agreement with a theory which attributes the forward peaking of fast photoneutron angular distributions to proton-neutron collisions within the nucleus where the photon was absorbed. (D.C.W.)

3250 CHARACTERIZATION OF COLLECTIVE LEVELS OF ATOMIC NUCLEI BY SCATTERING OF α AND α^3 PARTICLES. R. Ceuleneer. Bull. Classe Sci., Acad. Roy. Belg., (5) 50: 358-69(1964). (In French)

The differential cross sections for the excitation of collective levels of single-closed-shell nuclei by means of α- and ^{3}He-particle scattering are derived using a plane-wave first Born approximation and a two-body force between the nucleons of the projectile and those of the target. The collective levels of the target are described in the frame of a quasi-particle representation. The results obtained are compared to those of the diffraction model for α-particle scattering. (auth)

3251 THE PROBABILITY OF THE REACTION Mu-PLUS Li_6 YIELDS He_6 PLUS Nu. Cheng-jui Ching. Chung Kuo K'o Hsueh, 13: 337-8(1964).

The capture of a μ^--meson by ^{6}Li is of considerable interest since this reaction is more suitable than the capture of a meson by ^{12}C for determining the Gamow-Teller constant. Errors in previous calculations on the radial wave function of ^{6}Li are pointed out. Use was made of the work of Bienlein and Pleasonton (Nucl. Phys., 37: 529(1962)), who found $f_t = 794$ for the ^{6}He atom, to determine the value of the radial wave function of this atom and hence to obtain $d_2 = 4.3 \times 10^{-13}$ cm. Using Pustovalov's equation (ZhETF, 36, 1806, 1959) for the field around a homogeneously charged sphere, which decreases the probability of the Li to He transmutation by 7%, the probability was calculated as 1.06×10^3/sec. (TCO)

3252 β SPECTRA FROM THE ($2^- \rightarrow 2^+$) (960 kev) TRANSITION OF GOLD-198. CONVERSION COEFFICIENT FOR THE ELECTROMAGNETIC TRANSITION FROM 412 kev OF MERCURY-198. Daniel Parsignault. Compt. Rend., 259: 1515-16(Aug. 24, 1964). (In French)

The internal β spectrum of ^{198}Au was obtained using a solenoid spectrometer with uniform magnetic field by coincidence between the electrons and gammas at 412 kev. The spectrum did not have the statistical form and its form factor was $C(W) = 1 - 0.33W + 0.068\ W^2$. The conversion coefficients of the 412-kev transition of ^{198}Hg are $\alpha_K = 283 \pm 10 \times 10^{-4}$, $\alpha_L = 111 \pm 6 \times 10^{-4}$, and $\alpha_{M+N} = 31 \pm 3 \times 10^{-4}$. (tr-auth)

3253 MEASUREMENT OF THE LIFETIME OF THE 145-kev LEVEL IN PRASEODYMIUM-141. Maurice Dorikens, Oscar Segaert, Jan Demuynck, Liliane Dorikens-Vanpraet (Rijuniversiteit, Ghent). Compt. Rend., 259: 1724-6(Sept. 7, 1964). (In French)

The lifetime of the 145-kev level in ^{141}Pr was measured using a time-amplitude convertor. A half life of $2.06 \pm 0.03 \times 10^{-9}$ sec was obtained. (tr-auth)

3254 PROPERTIES OF MATTER BELOW NUCLEAR DENSITIES. E. V. Chubaryan (Central Lab. of Scientific-Research in Physics and Tech., Academy of Sciences, Armenian SSR). Dokl. Akad. Nauk Arm. SSR, 38: 17-21(1964). (In Russian)

Particles of matter at a density lower than nuclear and a lower temperature than the temperature of degeneration were studied. The matter was found to consist of the nuclei and a degenerate electron gas when $\rho < 2.6 \times 10^{11}$ g/cm^3. The dependence of the ratio of atomic number to atomic weight on density was derived mathematically. The tunnel effect was used to investigate the formation of heavy nuclei from light nuclei. At $\rho \approx 3 \times 10^3$ g/cm^3 H disappeared and at $\rho \approx 7.2 \times 10^7$ and $\rho = 3.95 \times 10^{10}$ g/cm^3 ^{4}He and ^{11}B, respectively, disappeared. It was concluded that at an electron energy on the order of $E_e > 20$ Mev only nuclei with atomic numbers greater than 12 can exist for any length of time in matter. (M.C.G.)

3255 ON THE THEORY OF THE INTEGRAL TRANSFORMATIONS WITH MITTAY-LEFLEUR NUCLEI. M. M.

Dzhrbashyan and S. A. Akopyan (Inst. of Math and Mechanics, Academy of Sciences, Armenian SSR). Dokl. Akad Nauk Arm. SSR, 38: 207-16(1964). (In Russian)

3256 THERMAL NEUTRON CAPTURE γ-RAYS OF LOW ENERGY IN Pr, Tb, Dy. A. Foglio Para and M. Mandelli Bettoni (CESNEF, Milan). Energia Nucl. (Milan), 11: 612-15(Nov. 1964).

The low-energy part of the spectrum of thermal neutron capture gamma rays in Dy, Pr, and Tb was investigated, using a scintillation spectrometer. The energies and intensities of the observed gamma lines were calculated and compared with previous results. (auth)

3257 STUDY OF THE SPALLATION PRODUCED IN NUCLEAR EMULSION BY 600-Mev PROTONS. Cl. Bovet (Université, Neuchatel, Switzerland). Helv. Phys. Acta, 37: 361-90(1964). (In French)

Many-prong stars produced by 600-Mev protons hitting AgBr in emulsion have been selected to improve the distinction between cascade and evaporation processes in the study of the mechanism of spallation. A careful investigation of the kinematics of the emitting nucleus, allowing the interpretation of the measured angular distribution, has made possible the evaluation of the fraction of particles originating in direct processes. The results obtained are: for charge-1 particles, (22 ± 4)%; and for charge-2 particles (mainly α particles) essentially 0%. Together with previous observations, the data suggest that the expulsion of α particles from the nucleus by direct collisions occurs mainly through peripheral impacts giving stars with few prongs; many-prong stars presumably being produced in central collisions. Assuming this small contribution of direct processes, a better interpretation of the energy spectra of evaporating particles based on the standard statistical theory is possible. The measured spectra have been corrected taking into account the motion of the emitting nucleus as revealed by the observation of short recoil tracks. Agreement with theory is obtained in this way, using a common initial temperature T_i for charge 1 and charge 2 particles. T_i has been deduced from the mean excitation energy at the beginning of the evaporation, obtained from the Monte Carlo calculations of the cascade. The theoretical energy spectra are based on an analytical expression that incorporates the cooling process of the emitting nucleus. The directions of the short tracks and of the recoils are correlated. From this finding, one can deduce that low-energy particles are not emitted at the beginning but essentially at the end of the evaporation process. The measured emission ratio of charge 1 to charge 2 particles (1.66 ± 0.10) is not explained by the evaporation theory. (auth)

3258 FORMATION OF INTERNAL PAIRS IN M1 TRANSITIONS. R. J. Lombard (Universite de Paris, Orsay, France) and W. Fischer. Helv. Phys. Acta, 37: 429-38(1964). (In French)

The internal pair formation is studied for the M1 transitions. Approximations are discussed. Several positron pair spectra have been computed for different values of Z and k. It is shown that the nuclear structure effects may be observed. The coefficient of monoenergetic positron formation has also been computed. (auth)

3259 MEASUREMENT OF DIFFERENTIAL SCATTERING CROSS SECTIONS OF ^{18}O FOR NEUTRONS IN THE ENERGY RANGE 2.9–4.1 Mev. P. Extermann, E. Baumgartner, and P. Huber (Universitat, Basel). Helv. Phys. Acta, 37: 505-20(1964). (In German)

We have measured the neutron differential cross sections of ^{18}O, detecting the recoils in an ionization chamber. The neutrons produced by the d-d reaction were monitored by a calibrated Hornyak scintillator. Some of the recoil spectra show a superposition of elastic and inelastic scattering due to the (2^+, 1.98 Mev) level of ^{18}O. At 3.4 Mev an inelastic cross section of 0.9 ± 0.2 barn is observed. The nuclear optical model gives a reasonable fit for the 4 Mev data. (auth)

3260 EXCITED STATES OF Rh^{104}. A. S. Melioranskii, L. F. Kalinkin, and I. V. Estulin (Moscow State Univ.). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1110-17 (July 1964). (In Russian)

New data on the energy of soft γ quanta from the $^{103}Rh(n,\gamma)^{104}Rh$ reaction, excitation of lower levels of ^{104}Rh, and measurements of cascade γ quanta in $^{103}Rh(n,\gamma)^{104}Rh$ were used to verify excited states of ^{104}Rh and the transitions between the levels. (R.V.J.)

3261 ELASTIC SCATTERING OF PROTONS ON TRITIUM AT ENERGIES BELOW THE (p,n) REACTION THRESHOLD. Yu. G. Balshko, I. Ya, Barit, L. S. Dul'kova, and A. B. Kurepin (Lebedev Inst. of Physics, Moscow). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1124-36(July 1964). (In Russian)

A phase analysis of p-t scattering at <1 Mev by R. M. Frank et al. (Phys. Rev., 99: 1406(1955)) revealed resonance phase behavior and the S state and determined resonance parameter levels. However, the analysis was simplified by neglecting the $T(p,n)^3He$ reaction and by assuming that the p-phases in two-spin states are equal to each other but different in sign. Measurements were made of the cross sections for elastic scattering of protons on tritium at 300 to 1000 kev, and a phase analysis was made without the above mentioned simplifications. The results showed the existence of a considerable excitation state for the compound nucleus ^4He, distributed somewhat below the threshold reaction $T(p,n)^3He$. The existence of a ^4He level (~20 Mev) was revealed in various other nuclear reactions with the compound nucleus ^4He. Correlations with available experimental data either confirmed the existence of the ^4He state or did not contradict it. (R.V.J.)

3262 INELASTIC SCATTERING OF PROTONS BY Ar^{36} NUCLEI. A. K. Valter, E. G. Kompanets, A. N. L'vov, and S. P. Tsynko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1137-9(July 1964). (In Russian)

Studies were made of inelastic scattering of protons by ^{36}Ar nuclei with the first-level excitation (1.97 Mev) at proton energies of 2.7 to 3.5 Mev corresponding to the ^{37}K excitation levels at 4.5 to 5.3 Mev. The results revealed three resonances at E_p = 2970, 3050, and 3375 kev. The experimental resonance width was 3 ± 0.5 kev. The relative yield of 1.97-Mev γ rays was plotted as a function of the incoming proton energy. Angular distributions of the 1.97-Mev γ rays at E_p = 2970, 3050, and 3375 kev were analyzed and compared with theoretical data. (R.V.J.)

3263 RADIATIVE CAPTURE AND INELASTIC PROTON SCATTERING BY ^{26}Mg NUCLEI. A. K. Val'ter, E. G. Kopanets, A. N. L'vov, and S. P. Tsytko (Inst. of Physics and Tech., Academy of Sciences, USSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1140-4(July 1964). (In Russian)

Monoenergetic protons were used to observe 29 resonances in $^{26}Mg(p,\gamma)^{27}Al$ reactions at proton energies from 2.3 to 2.9 Mev and 49 resonances in $^{26}Mg(p,p'\gamma)^{26}Mg$ reactions at 2.3 Mev < E_p < 3.3 Mev. (R.V.J.)

3264 ELASTIC PROTON SCATTERING BY ^{36}Ar NUCLEI. V. E. Storizhko and A. I. Popov (Inst. of Physics and Tech., Academy of Sciences, USSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1145-51(July 1964). (In Russian)

The elastic scattering process $^{36}Ar(p,p)^{36}Ar$ was studied at proton energies from 1500 to 3650 kev. Three resonances were found in the energy interval 2700 to 3500 kev for the 1.97-Mev γ-ray yield at E_p = 2970, 3050, and 3375 kev. The spin and parity of ^{37}K levels corresponding to the energy excitations 4.75 ($5/2-$, $7/2+$), 4.83 ($5/2+$), and 5.14 Mev ($5/2-$) were also found. (R.V.J.)

3265 THE ^{30}P LEVELS APPEARING IN THE REACTION $^{29}Si(p,p)^{29}Si$. V. E. Storizhko and A. I. Popov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1152-5(July 1964). (In Russian)

Characteristics of the energy levels of ^{30}P in proton elastic scattering by ^{29}Si at 1200 to 2200 kev and at 90, 125, and 141° angles were investigated. (R.V.J.)

3266 THE ENERGY LEVELS OF ^{28}Si NUCLEI. Yu. P. Antuf'ev, O. E. Bedevi, L. M. El Nadi, D. A. E. Darvish,

and P. V. Sorokin (Dept. of Nuclear Physics, Atomic Energy Commission, Kair, Egypt and Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1156-9(July 1964). (In Russian)

The spins and parities of ^{28}Si were studied. The coefficients for various resonances and transitions are tabulated as well as the asymmetry of angular distributions in triple p, γ, γ correlations. (R.V.J.)

3267 INVESTIGATION OF THE LOWER STATES IN ^{74}Ge, ^{78}Se, ^{93}Zr, AND ^{95}Zr BY MEANS OF STRIPPING REACTIONS. N. I. Zaika, O. F. Nemets, and A. M. Yasnogorskii (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1160-3(July 1964). (In Russian)

Stripping reactions of ^{73}Ge, ^{77}Se, ^{92}Zr, and ^{94}Zr were studied in order to determine the quantum characteristics and to determine the applicability of certain models for various nuclear regions. Studies made with scintillation spectrometers using targets of thin zirconium oxide-enriched powders or Ge and Se deposited on polystyrene base were not very accurate. More accurate measurements were obtained by comparisons of proton yields from (d,p) reactions with deuteron elastic scattering at small angles ($\leq$20°), where Rutherford scattering was taking place, at deuteron energies of 13.6 Mev. Angular distributions of protons corresponding to the transitions to the product nuclei ^{74}Ge, ^{78}Se, ^{93}Zr, and ^{95}Zr are plotted. Correlations of angular moments, spins, and parities of the final state with theoretical data are tabulated. (R.V.J.)

3268 STUDIES OF THE LOW ^{28}Si STATES PRODUCED BY THE $Al^{27}(\alpha,t)Si^{28}$ REACTION. O. F. Nemets, A. T. Rudchik, and V. A. Usik (Inst. of Physics, Academy of Sciences, Ukrainian SSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1164-8(July 1964). (In Russian)

The $^{27}Al(\alpha,t)^{28}Si$ reaction was used to obtain spectroscopic data for ^{28}Si. Two groups of tritons corresponding to production of ^{28}Si in its ground and excited state ($E_{excit} \cong$ 1.78 Mev) were studied. The triton angular distribution shows a sharp forward direction. The pole and triangle diagrams indicate a stripping process in the formation of ^{28}Si. The results indicate the feasibility of using (α,t) reactions for spectroscopic data; however, various distortions and mechanisms must be taken into account in evaluating angular distributions. (R.V.J.)

3269 GIANT RESONANCE IN ^{6}Li PHOTOSPALLATION. R. A. Eramzhyan (Moscow State Univ.). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1181-4(July 1964). (In Russian)

Two maxima were observed in the absorption cross section region of the ^{6}Li giant photospallation resonance. The first maximum was found at E_γ = 12.5 Mev and was due to γ quantum absorption by the p-shell nucleons. The second maximum was at E_γ = 25 Mev and was the result of γ quantum absorption by the s-shell nucleons. The quasi-stationary state decay at E = 12.5 Mev followed the dip of the channel and emitted high-energy nucleons. The state at E = 25 Mev decayed into three particles producing low-energy deuterons. The theoretical and experimental data on nuclear photospallation at the ^{6}Li and ^{7}Li p shell confirmed the presence of two maxima. The first maximum was related to the transition $1p \rightarrow (1d,2s)$ and the second to transitions $1s^4 1p^n \rightarrow 1s^3 1p^{n+1}$. (R.V.J.)

3270 ON THEORY OF SUPERFLUIDITY OF NUCLEAR ATOMS. B. L. Birbrair (Ioffe Inst. of Physics and Tech., Leningrad). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1185-7(July 1964). (In Russian)

An attempt was made to find a criterion at which the number of excited external nuclei become superfluid. The investigation was confined to the region of spherical nuclei near ^{208}Pb. (R.V.J.)

3271 THE ALPHA DECAY OF ^{222}Ra AND THE STRUCTURE OF RADON ISOTOPE LEVELS. K. B. Baktylaev and G. M. Bukat (Ioffe Inst. of Physics and Tech., Leningrad). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1203-6(July 1964). (In Russian)

Calculations were made of the α transition ^{222}Ra $\rightarrow$ ^{218}Rn. The data obtained were used to verify the quantum characteristics of the lower radon excited states. The analysis suggested that α decay of the ground state of ^{222}Ra to ^{218}Rn is 0^+, 2^+, 0^+_2, 1^-, and 4^+. The similarity of the lower excited state properties of ^{218}Rn indicates that 0^+_2 instead of 2^+ is the second excited state of ^{220}Rn and ^{222}Rn. It was shown that coefficients of forbiddenness depend on the state and can vary from level to level. (R.V.J.)

3272 ALPHA PARTICLE WIDTH IN Bi^{210} AND Tl^{206} SPECTRUM LEVELS. K. B. Baktybaev and G. M. Bukat (Ioffe Inst. of Physics and Tech., Leningrad). Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1229-33(July 1964). (In Russian)

The shell model was used in studies of $^{210}Bi \xrightarrow{\alpha} {}^{206}Tl$, and the influence of tensor forces in residual interactions on the behavior of odd-odd nuclear levels was estimated. At arbitrary central residual force parameters the three lower level pairs for ^{206}Tl belong to $p_{\frac{1}{2}}s_{\frac{1}{2}}$ (0.1), $p_{\frac{1}{2}}d_{\frac{5}{2}}$ (2.1), $f_{\frac{5}{2}}s_{\frac{1}{2}}$ (2.3) doublets with a negligible spallation of 0 to 1 $p_{\frac{1}{2}}s_{\frac{1}{2}}$ doublet. The ground state of ^{210}Bi is a mixture of many configurations ($g_{\frac{9}{2}}h_{\frac{9}{2}}$ and $i_{\frac{13}{2}}h_{\frac{9}{2}}$) with the largest input from the second set, while the adjacent levels can be represented as $g_{\frac{9}{2}}h_{\frac{9}{2}}$ multiplet. It was postulated that in spite of the factor that tensor forces are negligible in even-even nuclei, their contribution to residual interactions in odd-odd nuclei may be of importance. The structural probabilities of α structures in ^{210}Bi and ^{206}Tl are tabulated. (R.V.J.)

3273 GAMMA-RAY SPECTRUM FROM THE $Fe^{56}(n,\gamma)Fe^{57}$ REACTION. L. V. Groshev, A. M. Demidov, G. A. Kotel'nikov and V. N. Lutsenko. Izv. Akad. Nauk SSR, Ser. Fiz., 28: 1234-43(July 1964). (In Russian)

A magnetic Compton spectrometer with 0.3% and 0.6% resolving power at $E_\gamma > 2$ Mev and $E_\gamma = 1$ Mev, respectively, was used for measuring γ-ray spectra emitted during neutron capture by ^{56}Fe. The cross section for thermal neutron capture by natural mixtures of isotopes is equal to $\sigma = 2.53 \pm 0.06$ barn. Transitions of ^{57}Fe and decay levels are analyzed. (R.V.J.)

3274 GAMMA RAYS AND INTERNAL CONVERSION ELECTRONS FROM THE $Hf^{177}(n,\gamma)Hf^{178}$ REACTION. L. V. Groshev, A. M. Demidov, V. A. Ivanov, V. N. Lutsenko, and V. I. Pelekhov. Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1244-54(July 1964). (In Russian)

A magnetic Compton γ spectrometer with 0.3 and 0.6% resolving power at $E_\gamma > 2$ and $E_\gamma \sim 1$ Mev, respectively, was used for measuring the lower levels of ^{178}Hf in the $^{177}Hf(n,\gamma)^{178}Hf$ reaction. Nearly 10 levels were established for ^{178}Hf at 1 to 1.5 Mev. However, the developed scheme of levels demands further checking of the characteristics of the decay levels. (R.V.J.)

3275 GAMMA EMISSION FROM ^{243}Cm AND ^{242}Cm. I. A. Baranov, A. S. Krivokhatskii, and A. N. Silant'ev. Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1255-6(July 1964). (In Russian)

A gamma spectrometer with a resolving power of 10% for 662-kev γ rays was used for determining the absolute intensity of ^{243}Cm γ emission per α decay. The α-γ coincidence method permitted reduction of the γ background to a minimum. The absolute intensity of ^{243}Cm γ emission per α decay at the γ-ray energy of 100, 200, and 277 kev was (42 ± 6), (11.3 ± 1.7), and (11.2 ± 1.7)%, respectively. Investigation of γ spectra for ^{242}Cm indicated that the number of γ quanta per α decay at E_γ = 44 kev was $(2.7 \pm 0.5) \times 10^{-2}$%. (R.V.J.)

3276 FLUORESCENCE YIELD FOR Np AND Pu L SHELL. G. G. Akalaev, N. A. Vartanov and P. S. Samoilov. Izv. Akad. Nauk SSSR, Ser. Fiz., 28: 1259-63(July 1964). (In Russian)

The mean fluorescence yield for Z = 93 and Z = 94 nuclei from ^{241}Am and ^{242,244}Cm decay was estimated using a magnetic double-focusing β spectrometer. (R.V.J.)

3277 ANGULAR DISTRIBUTIONS OF NEUTRON REACTION $N^{14}(d,n)O^{15}$. N. V. Zinov'ev (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 3, 41-3(1964). (In Russian)

The angular distribution from $^{14}N(d,n)^{15}O$ at E_d = 1.96

Mev was calculated using the theory of G. E. Owen et al. (Phys. Rev., 105: 1766, 1957). Correlations of experimental and theoretical distribution curves indicated the theory quantitatively describes the distribution and the energy dependence. (R.V.J.)

3278 ON THE PARAMETER OF NON-AXIAL DEFORMED EVEN-EVEN NUCLEI. P. B. Begzhanov and S. Ya. Rakovitskii (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 3, 71-2(1964). (In Russian)

The method of R. K. Sheline (Nucl. Phys., 31: 1962) was used in analysis of the relation between $E_1(2) \cdot A$ and γ^0 for all known even-even deformed nuclei from A = 24 to 254. The nonaxiality parameter was determined using the ratio of the two first levels with spins 2^+. The analysis did not exhibit a simple linear ratio for all points. The largest variation (20%) was found in the region $\gamma^0 < 15°$. The highest nonaxiality was observed for nuclei whose proton numbers differ by 2 or 4 units from 28, 50, and 82 (Pd, Cd, Te, Xe, and Pt). These nuclei appeared considerably above the predicted straight line. (R.V.J.)

3279 A NOTE ON AN ALTERNATIVE INTERPRETATION OF NUCLEAR SHELL MODEL. Gentaro Araki (Kyoto Univ.). J. Phys. Soc. Japan, 19: 1514-17(Sept. 1964).

An elementary account of one-nucleon states and levels is given in an interpretation of the shell model in which $\sigma \cdot x$ term is assumed in the one-nucleon hamiltonian instead of an $L \cdot S$ term. It is shown that the hamiltonian gives an inverted doublet system of energy levels and nuclear magnetic moments with values between the Schmidt lines. (auth)

3280 ON THE THEORY OF NUCLEAR REACTIONS. Yasushi Wada (Univ. of Pennsylvania, Philadelphia). J. Phys. Soc. Japan, 19: 1518-28(Sept. 1964).

A formalism of the theory of nuclear reactions is presented. The transition matrices are given as matrix elements between the initial state of the target nucleus and the final state of the residual nucleus. It can be calculated by solving a many body problem of the total system during the collision processes, which is formulated in a form similar to the nuclear structure problem. The effects of the identity of nucleons are completely taken into account. The amplitudes of elastic and inelastic neutron scattering are formally derived. The self-consistent conditions for the optical potential are obtained and examined in the lower-order approximations with respect to the residual interactions between the nucleons. The effects of the singular interactions between the nucleons can be taken into account. The applicability of this formalism to other reactions is pointed out. (auth)

3281 ON THE FOUNDATION OF PHENOMENOLOGICAL NUCLEAR MODELS. Jun-Ichi Fujita (Tokyo Univ.). J. Phys. Soc. Japan, 19: 1528-32(Sept. 1964).

An attempt is made to reformulate the nuclear many-body problem in perturbation-like forms. Several possible ways of improving the existing models are suggested. (auth)

3282 COMPRESSIBLE OSCILLATIONS OF HEAVY NUCLEI AND THE GIANT RESONANCE ENERGIES. Takehiko Ishidzu and Hideo Kawarada (Tokyo Univ.). J. Phys. Soc. Japan, 19: 1533-8(Sept. 1964).

Compressible oscillations of heavy nuclei are treated by the hydrodynamical method using the statistical model. The oscillations are assumed to be small perturbations to the static equilibrium of the nucleus with constant density. Two energy expressions are used: the purely statistical expression from the Thomas-Fermi-Dirac method for attractive central Yukawa potentials and that from the K-matrix method for nuclear matter with the Gammel-Thaler potential. From the lowest eigenfrequencies of the oscillations obtained, corresponding quantum-mechanical excitation energies are calculated; those for the mode l = 1 are shown to be comparable with the giant resonance energies in photonuclear reactions of heavy nuclei. (auth)

3283 QUADRUPOLE COUPLING IN THE HYPERFINE STRUCTURE OF THE SPECTRUM OF IODINE-II. Kiyoshi Murakawa (Tokyo Univ.). J. Phys. Soc. Japan, 19: 1539-41 (Sept. 1964).

The hfs of the level $5s5p^5\ ^3P_2$ was studied; and the quadrupole moment Q' (^{127}I) without shielding correction was determined to be -0.49 ± 0.08 b, whereas the value of Q' deduced from $5p^5\ ^2P_{\frac{3}{2}}$ and $6s^4P_{\frac{3}{2}}$ and $7p^4D_{\frac{5}{2}}$ levels of I (I) is -0.66 b, the most probable value of Q being -0.62 b. This discrepancy indicates that the shielding correction for the configuration $5s5p^5$ of I (II) is positive. The interval factor of the level $5s5p^5\ ^1P_1$ was found to be too large to give proper interpretation. (auth)

3284 THE DECAY OF Ba^{131} AND EXCITED LEVELS IN Cs^{131}. Tachishige Hirose and Kazuo Hisatake (Tokyo Inst. of Tech.). J. Phys. Soc. Japan, 19: 1542-9(Sept. 1964).

The decay of ^{131}Ba was studied with a magnetic beta spectrometer and NaI scintillation spectrometers. Twenty-two transitions in ^{131}Cs were observed in the internal conversion spectrum. A previously unreported level in ^{131}Cs was found at 594 kev. The gamma-gamma angular correlation for the 924-124 kev cascade in ^{131}Cs was observed to be $W(\theta) = 1 + (0.0012 \pm 0.016)\ P_2(\cos\theta) + (0.011 \pm 0.029)\ P_4(\cos\theta)$. The spins and parities of excited states of ^{131}Cs were assigned from the multipolarities which were determined by the internal conversion and the angular correlation. (auth)

3285 GAMMA-RADIATION OF U^{235} FISSION PRODUCTS IN THERMAL FISSION. L. Albrecht (VEB Atomkraftwerk, Berlin). Kernenergie, 7: 604-10(Aug. 1964). (In German)

The total activity, total gamma energy, and specific gamma activity from ^{235}U fission products were calculated for reactor operating times ranging from 1 hr to 2 yr and decay times varying from 10^2 to 10^{10} sec. The results are tabulated. (auth)

3286 TREIMAN-YANG CRITERION FOR DIRECT NUCLEAR REACTIONS. I. S. Shapiro (Moscow State Univ.), V. M. Kolybasov, and G. R. Augst. Nucl. Phys., 61: 353-67(Jan. 1965).

The reactions $A + x \rightarrow B + y + z$ are considered in the pole approximation. Cases of applicability of the Treiman-Yang criterion for virtual non-zero spin particles are indicated. A general formula is obtained for the differential cross section of the reaction with arbitrary spins of the particles involved. (auth)

3287 THE $O^{16}(He^3,\alpha)O^{15}$ AND THE $O^{16}(He^3,He^3)O^{16}$ REACTIONS. W. Parker Alford, L. M. Blau, and D. Cline (Univ. of Rochester, N. Y.). Nucl. Phys., 61: 368-80 (Jan. 1965). (UR-875-47)

Angular distributions of the $^{16}O(^3He,\alpha)^{15}O$ g.s. reaction were measured over the range 2.5 to 172° at laboratory energies of 8, 8.5, 9, 9.42, and 10 Mev. Excitation functions were also measured at angles of 45, 75, and 150° over this energy range. The peak and the total cross section varies by a factor of two over this energy range indicating an appreciable compound nucleus contribution to the reaction. The elastic scattering of ^{3}He from ^{16}O was measured at 8.5 and 9.42 Mev, and the results analyzed by the optical model to provide parameters for a DWBA calculation of the reaction cross section. The DWBA calculations gave a good fit to the shape of the forward peak at all energies except 8.5 Mev, although a disturbingly large radial cut-off was required. The calculated cross section was smaller than the measured cross section by an average factor of 17. An attempt was made to include a compound nucleus contribution in the calculated cross section. The detailed fit to the shape of the measured cross sections was improved slightly and some of the observed energy variation was accounted for. The magnitude of the compound nucleus contribution required is in agreement with estimates of the geometric cross section and the number of open channels. (auth)

3288 TOTAL NEUTRON CROSS SECTIONS AT 1.44 ev. L. A. Rayburn and E. O. Wollan (Oak Ridge National Lab., Tenn.). Nucl. Phys., 61: 381-4(Jan. 1965). (ORNL-P-39)

Neutron transmission cross sections of several ele-

ments, separated isotopes, and compounds were measured at the in n resonance energy, 1.44 ev. (auth)

3289 THE DECAY OF Ir^{192}. M. W. Johns and M. Kawamura (McMaster Univ., Hamilton, Ont.). Nucl. Phys., 61: 385-93(Jan. 1965).

The end-points and absolute intensities of the partial beta spectra in the decay of ^{192}Ir were determined by magnetic spectrometric and coincidence measurements. The beta group feeding the 0.785-Mev state has an end-point of 0.672 ± 0.004 Mev and an intensity of 46 ± 4%; the corresponding values for the beta rays feeding the 0.921- and 1.200-Mev levels are 0.536 ± 0.004 Mev with an intensity of 41 ± 4% and 0.240 ± 0.015 Mev with an intensity of 8 ± 2%. The intensity values are based on the assumption that 95% of the ^{192}Ir decays are in the β-branch. Gamma-gamma angular correlation measurements of the 1.06–0.316 and 0.885–0.316 Mev cascades lead to spin assignments of 3 and 4, respectively, for the 1.380- and 1.200-Mev states in ^{192}Pt. (auth)

3290 THE DECAY OF Ir^{194}. J. D. MacArthur and M. W. Johns (McMaster Univ., Hamilton, Ont.). Nucl. Phys., 61: 394-416(Jan. 1965).

Measurements of β-γ, e-γ, e-β, and γ-γ coincidences were carried out with magnetic and scintillation spectrometers to determine the absolute intensities of the beta and gamma rays accompanying the decay of ^{194}Ir. The beta rays feeding the 0.328-, 0.622-, and 1.267-Mev levels of ^{194}Pt have intensities of 5.1 ± 0.6, 1.2 ± 0.2 and 2.0 ± 0.2%, respectively. These were used to establish the absolute intensities of the gamma rays. The relative gamma ray intensities are compared with those of other workers. Angular correlation measurements indicate that the spins of the levels at 1.267, 1.480, 1.512, 1.798, and 2.114 Mev are 0, 0, 1, 1, and 2, respectively. (auth)

3291 EXACT CALCULATION OF INELASTIC ELECTRON SCATTERING BY NUCLEI. Thomas H. Schucan (Univ. of Basel). Nucl. Phys., 61: 417-47(Jan. 1965).

An exact calculation of the cross section for inelastic scattering of high-energy electrons by nuclei was carried out. The general formulas are derived under the assumption of the vibrational model of the nucleus. In the case of monopole excitations, the cross sections obtained with the vibrational model are compared with cross sections obtained from different transition charge densities. Numerical results calculated for different nuclei and electron energies are compared with the corresponding Born approximation values. It is shown how the discussion of experimental results can be facilitated by some qualitative and quantitative considerations. (auth)

3292 PROTON EXCITATION OF VIBRATIONAL STATES OF ^{126}Te. G. C. Pramila (Oxford Univ.), R. Middleton, T. Tamura, and G. R. Satchler. Nucl. Phys., 61: 448-56(Jan. 1965).

The differential cross sections for the elastic and inelastic scattering of 12-Mev protons by ^{126}Te were measured. The results are interpreted in terms of the collective model using both the distorted-wave and coupled-channel methods. The quadrupole and octupole vibrational states are identified at 0.67 and 2.395 Mev, respectively. Levels at 1.36 and 1.42 Mev are interpreted as due to two-quadrupole phonons. Scattering to some of the group of states just above 2 Mev is in agreement with the predictions for the excitation of three quadrupole phonons. (auth)

3293 THE NEUTRON-NEUTRON AND NEUTRON-DEUTERON TOTAL CROSS-SECTION IN THE ENERGY RANGE 15-120 Mev. R. A. J. Riddle (Oxford Univ.), A. Langsford, P. H. Bowen, and G. C. Cox. Nucl. Phys., 61: 457-64(Jan. 1965). (AERE-NP/GEN-36)

The difference between the n-d and n-p total cross sections was measured in the energy range 15 to 120 Mev. This is found to be close to the value of the n-n total cross section calculated (on the assumption of charge symmetry) from proton-proton phase shifts. The residual discrepancy can be accounted for by a multiple scattering correction based on a value of the mean inverse square radius of the deuteron equal to 0.280 ± 0.033 f^{-2}. The n-d total cross section was deduced from the present data and previous measurements of the n-p total cross section. (auth)

3294 THE ELECTRON CAPTURE DECAY OF 140 DAY Lu^{174}. L. Funke, H. Graber, K.-H. Kaun, H. Sodan, and L. Werner (Zentralinstitut für Kernforschung, Rossendorf, Ger.). Nucl. Phys., 61: 465-71(Jan. 1965). (In German)

In the decay of Lu sources produced by the reactions Yb(d,2n) and Lu(n,2n), two new cascades 995–280–175–76.5 kev and 630–365–280–175–76.5 kev were found. The intensity ratio of the cascades 995–280 kev and 630–365 kev is $I_{995-280}/I_{630-365} = 41 \pm 5$. The measurement of the half life time permits the attribution of the transitions to the electron capture decay of the isomeric state of $^{174}Lu(T_{\frac{1}{2}} = 140\ d)$. A level scheme is proposed which contains a level at 1526 kev with $I^{\pi} = 7^-$ interpreted as a two quasiparticle state (K, K + 2) of the neutron system with the characteristic [624↑ + 512↑]. Coming from this state the 995- and 630-kev transitions populate a 532-kev level (6^+) and a 897-kev level (8^+), belonging to the ground state rotational band. (auth)

3295 PRECISION HALF-LIFE MEASUREMENTS OF FOURTEEN POSITRON-EMITTING NUCLEI. Thomas G. Ebrey and Peter R. Gray (Phillips Petroleum Co., Bartlesville, Okla.). Nucl. Phys., 61: 479-92(Jan. 1965).

Precision half lives were measured for fourteen positron-emitting nuclides. The weighted average half lives are ^{13}N, 9.96 ± 0.02 min; ^{18}F, 109.87 ± 0.12 min; ^{30}P, 2.49 ± 0.01 min; ^{34m}Cl, 31.99 ± 0.05 min; ^{38}K, 7.70 ± 0.02 min; ^{53}Fe, 8.51 ± 0.02 min; ^{57}Ni, 35.99 ± 0.12 h; ^{62}Cu, 9.76 ± 0.02 min; ^{68}Ga, 68.33 ± 0.09 min; ^{91}Mo, 15.49 ± 0.01 min; ^{106}Ag, 23.96 ± 0.04 min; ^{108}Ag, 2.41 ± 0.02 min; ^{120}Sb, 15.89 ± 0.04 min; and ^{140}Pr, 3.39 ± 0.01 min. (auth)

3296 THE SIGN OF THE E0 STRENGTH PARAMETERS IN THE $2^+ \rightarrow 2^+$ TRANSITIONS IN Os^{188} AND Os^{190}. Toshimitsu Yamazaki (Tokyo Univ.). Nucl. Phys., 61: 497-9(Jan. 1965).

Earlier results of electron–gamma directional correlation experiments in ^{188}Os and ^{190}Os were re-analyzed taking into account the sign reversal of the particle parameter in the M1–E2 interference term. The results are compared with the predictions of conventional collective models. (auth)

3297 THE DECAY OF Au^{198}. W. J. Keeler and R. D. Connor (Univ. of Manitoba, Can.). Nucl. Phys., 61: 513-23 (Jan. 1965).

In disagreement with recent suggestions that the principal first-forbidden non-unique beta transition requires a shape factor for its complete description, it was found that this transition displays the statistical shape. The coefficients of the shape factors suggested earlier are shown to be so extremely sensitive to the choice of end-point energy as to make their utility doubtful. The conversion coefficients of the 412-kev transition were determined at high precision and found to be in complete agreement with the theoretical E2 values. The results of observations of the decay of ^{199}Au needed in the analysis are included. (auth)

3298 SCATTERING OF 14.1 Mev NEUTRONS FROM Si^{28} AND S^{32}. P. W. Martin, D. T. Stewart, and J. Martin (Glasgow Univ.). Nucl. Phys., 61: 524-8(Jan. 1965).

Elastic and inelastic scattering of 14.1-Mev neutrons from ^{28}Si and ^{32}S were studied by the associated-particle time-of-flight technique. Differential cross sections were determined for inelastic scattering from the first 2^+ states and compared with distorted-wave Born approximation calculations. (auth)

3299 THE DECAY OF 6 MIN Te^{115}. R. Reising and B. D. Pate (Washington Univ., St. Louis). Nucl. Phys., 61: 529-41(Jan. 1965).

The 6-min positron activity induced in tin by 20-Mev alpha-particle bombardment was studied. Its identification as ^{115}Te was confirmed. Studies of its radiations by means of scintillation spectroscopy have led to energy and intensity measurements of eight gammas and determination of the maximum positron energy of 2800 kev. Coincidence studies assisted construction of a tentative decay scheme. (auth)

3300 LEVELS AND LIFETIMES IN Pm^{149} AND Sm^{149}. W. M. Currie and P. W. Dougan (Glasgow Univ.). Nucl. Phys., 61: 561-81(Jan. 1965).

An investigation of the decay of ^{149}Nd was made with scintillation counters and fast coincidence techniques. Eighteen γ-rays were observed directly, seven of them delayed. By delayed gating methods the genetical relations among most of the γ-rays were established unambiguously and definite levels (with mean lives in nsec) are proposed for ^{149}Pm at 114 (3.64 ± 0.05), 189 (5.0 ± 0.2), 210 (≤ 0.5), 267 (3.72 ± 0.06), 530 (≤ 0.55), 537 (≤ 0.7), and 652 (≤ 0.26) kev. The resulting decay scheme, which includes three other possible levels, is rather different from that proposed recently by Gopinathan and Joshi, but is still quite consistent with their data on the β-spectra. In addition to the measurements on ^{149}Pm, the mean life of the 286-kev level in ^{149}Sm was measured as $(2.63 \pm 0.10) \times 10^{-10}$ sec. The 114-kev transition in ^{149}Pm and the 286-kev transition in ^{149}Sm (both largely M1 and probably l forbidden) are slower than the Weisskopf estimates by factors of 370 and 230, respectively, and some of the other transition rates appear to be anomalous. (auth)

3301 THE MAGNETIC MOMENT OF THE $^3/_2^+$ STATE IN Tl^{203} AND THE QUESTION OF CORE EXCITATIONS. E. Karlsson, E. Matthias, S. Gustafsson, K. Johansson, A. G. Svensson, S. Ogaza, and P. da Rocha Andrade (Uppsala Univ.). Nucl. Phys., 61: 582-92(Jan. 1965).

The nature of the $^3/_2^+$ state at 279 kev in ^{203}Tl is subject to a discussion based on a determination of its magnetic moment. The experimental value, obtained by perturbing the angular correlation of the 401−279 γ-γ cascade, is found to be very close to the Schmidt limit. The result, $\mu = +0.16 \pm 0.05$ nm, from a liquid source determination, is also discussed with regard to possible systematic errors. (auth)

3302 A DETERMINATION OF THE PSEC HALF LIFE OF THE 39.85 kev LEVEL IN Tl^{208}. K. D. Sevier (Uppsala Univ.). Nucl. Phys., 61: 601-12(Jan. 1965).

The half life of the 39.85-kev level in ^{208}Tl was measured by determining the distance the atoms recoil after alpha decay in ^{212}Bi before emitting a conversion electron. This was done by electrostatically collecting the activity on a very thin wire placed at a positive electrostatic potential with respect to a closely lying grounded grid. Conversion electrons would pass from the source, past the grid, and through a spectrograph for momentum analysis. The distance from the source wire at which the nuclei decay will result in an extension of the high-energy shoulder of the conversion line. The half life of the level was calculated from the analysis of this extension. A magnetic semicircular spectrograph, set for ≈0.03% resolution, was used for the momentum analysis, and electron detection was accomplished by a technique of counting electron tracks in a nuclear emulsion. The phenomenon of recoil straggling due to source thickness was observed and corrected for where necessary. The obtained half life is $T_{½} = 6.46 \pm 0.79$ psec, and $\tau_\gamma = (2.06 \pm 0.29) \times 10^{-10}$ sec. This is in agreement with de-Shalit's theoretical value of the life time for the $(s_{½}, g_{½})$ configuration. (auth)

3303 DECAY OF ^{135}La. S. Morinobu, T. Hirose, and K. Hisatake (Tokyo Inst. of Tech.). Nucl. Phys., 61: 613-24(Jan. 1965).

The decay of ^{135}La was studied by means of scintillation spectrometers and a magnetic beta spectrometer. New transitions of 373, 633, 655, and 852 kev were found in ^{135}Ba. Two transitions of 265 and 295 kev, reported previously, were found to be absent in the internal conversion spectrum. Positrons were not detected with a beta spectrometer, and an upper limit of 2×10^{-5} was placed on β^+/K from coincidences of annihilation quanta. Two new levels in ^{135}Ba are proposed at 852 and 871 kev in place of the 862-kev level previously reported. From the measurements of internal conversion electrons and the log ft values, the spins and parities of levels in ^{135}Ba are assigned as follows: 218($^1/_2^+$), 481 (probably $^5/_2^+$), 588 ($^3/_2^+$ or $^5/_2^+$), 852 ($^3/_2^+$ or $^5/_2^+$), and 871 ($^3/_2^+$ or $^1/_2^+$). (auth)

3304 THE ALPHA-PARTICLE BREAKUP OF THE 12.71 AND 11.83 Mev LEVELS IN C^{12}. W. C. Olsen, W. K. Dawson, G. C. Neilson, and J. T. Sample (Univ. of Alberta, Edmonton). Nucl. Phys., 61: 625-40(Jan. 1965).

The alpha decay of states in ^{12}C, with special emphasis on those at 11.83 and 12.71 Mev, was studied using the $^{11}B(d,n)^{12}C$ reaction. Neutron time-of-flight spectra and semiconductor detector charged-particle spectra were analyzed by a two-parameter pulse-height analyzer. Angular and energy distributions of the alpha particles from the 12.71- and 11.83-Mev states indicate that these states decay sequentially through ^8Be. The 1^+ spin-parity assignment for the 12.71-Mev state is supported by the fact that no transitions to the ground state of ^8Be were observed. Approximately 90% of the transitions from the 11.83-Mev state proceed via ^8Be(2.9 Mev) while the remaining 10% feed the ground state. There is some evidence to indicate that the 10.84-Mev state of ^{12}C decays exclusively to ^8Be(0). The 3^- assignment for the 9.64-Mev state in ^{12}C is favored over 1^- on the basis of the angular distribution of the alpha particles from this state to the ^8Be ground state. The work, together with other work reported in the literature, justifies the representation of ^{12}C as a $^8Be + \alpha$ two-body cluster from the alpha-particle threshold to 16 Mev. Such a representation is in accordance with the two-body cluster model of Phillips and Tombrello. (auth)

3305 ALPHA-GAMMA ANGULAR CORRELATION STUDIES OF THE REACTIONS $Si^{28}(\alpha,\alpha'\gamma_{1.77})$ AND $O^{16}(\alpha,\alpha'\gamma_{6.13})$. D. E. Blatchley and R. D. Bent (Indiana Univ., Bloomington). Nucl. Phys., 61: 641-56(Jan. 1965).

Alpha-gamma angular correlations were measured between inelastically scattered alpha particles and deexcitation gamma rays from the reactions $^{28}Si(\alpha,\alpha'\gamma)$ and $^{16}O(\alpha,\alpha'\gamma)$. All measurements were made in the reaction plane. The ^{28}Si reaction involves the excitation of a 2^+ level; angular correlations were measured at 41 scattering angles for this case. A 3^- excitation is involved in the ^{16}O reaction; angular correlations were measured at 24 scattering angles for this case. In both cases the data are found to disagree with the predictions of the plane-wave Born approximation (PWBA) and the adiabatic approximation. The results of three distorted-wave Born approximation (DWBA) calculations for the ^{28}Si reaction are presented. One of these calculations is shown to provide a reasonably good explanation of the experimental data at forward scattering angles. (auth)

3306 THE RELATIVE INTENSITY OF THE POSITRON BRANCH IN THE l-FORBIDDEN TRANSITION FROM THE GROUND STATE OF Co^{56} INTO THE SECOND EXCITED STATE OF Fe^{56}. D. Berényi and L. Kazai (Inst. of Nuclear Research, Hungarian Academy of Sciences, Debrecen). Nucl. Phys., 61: 657-60(Jan. 1965).

The relative intensity of the positron branch in the transition from the ground state of ^{56}Fe was measured by two different methods and calculated also from the γ-intensity data of Cook and Tomnovec. The weighted average of the three values is 0.893 ± 0.084 and the theoretical datum is 0.907. Some discussion is given on the ϵ/β^+ ratio in l-forbidden transitions. (auth)

3307 THE SECOND T = $^3/_2$ STATE OF Be^9. REMARKS ON THE A = 9 SYSTEM. J. B. Woods and D. H. Wilkinson (Oxford Univ.). Nucl. Phys., 61: 661-74(Jan. 1965).

The reaction $^7Li(d,p)^8Li$ was investigated for deuteron energies of 0.29 to 0.50 Mev by the method of residual activity. A resonance of width less than 2 kev is found at $E_d = 360 \pm 3$ kev. The same resonance is also found in the reaction $^7Li(d,\gamma)^9Be$ at $E_d = 362 \pm 3$ kev. This corresponds to a state in ^9Be at 16.974 ± 0.004 Mev. It is suggested that this is the second T = $^3/_2$ state of ^9Be, the first being that reported at 14.392 Mev; the spacing of 2.58 Mev is to be compared with the 2.69 Mev excitation of the first excited state of ^9Li. The structure of the A = 9 system is discussed in the light of the independent particle model. It is suggested that the mass of ^9C is such as to make it stable by about 1.0 Mev against proton emission. (auth)

3308 COULOMB EXCITATION OF Tm^{169}. J. De Boer (California Inst. of Tech., Pasadena). Nucl. Phys., 61: 675-81(Jan. 1965).

The Coulomb excitation of ^{169}Tm was studied using oxygen ions of energies up to 44 Mev as bombarding particles. De-excitation gamma rays were recorded in coincidence with back-scattered particles. The cascade/crossover branching ratios in the decay of the rotational levels of the $K = \frac{1}{2}$ band are compared with the predictions of the rotational model. It is found that, within experimental errors, a single set of rotational parameters g_R, g_K, b_0, and Q_0 describes all electromagnetic properties of the ground state band. Transitions assigned to gamma vibrational bands with $K_1 = K_0 \pm 2$ were also observed. (auth)

3309 THE ELECTROMAGNETIC PROPERTIES OF Tm^{169}. J. D. Bowman, J. de Boer, and F. Boehm (California Inst. of Tech., Pasedena). Nucl. Phys., 61: 682-8 (Jan. 1965).

The rotations of the angular correlation of the 198–118 kev and of the 177–130 kev cascades observed in the decay of ^{169}Yb into ^{169}Tm were measured in an external magnetic field. A source of $YbCl_3$, dissolved in water was used. With a paramagnetic correction factor of 5.31 for the enhancement of the magnetic field at the nuclear site, and the experimental values for the lifetimes of the $\frac{5}{2}$ and $\frac{7}{2}$ rotational states in ^{169}Tm, the magnetic moments $\mu_{\frac{5}{2}} = 0.61 \pm 0.12$ nm and $\mu_{\frac{7}{2}} = 1.31 \pm 0.18$ nm were derived. An analysis of all experimentally known electromagnetic properties of the ground-state rotational band in ^{169}Tm is presented, and it is found that fifteen measured electromagnetic quantities can be represented by one set of the four rotational parameters Q_0, g_K, g_R, and b_0. (auth)

3310 SU_3 RECOUPLING AND FRACTIONAL PARENTAGE IN THE 2s-1d SHELL. K. T. Hecht (Univ. of Michigan, Ann Arbor and Universitet, Copenhagen). Nucl. Phys., 62: 1-36(Feb. 1965).

Explicit algebraic expressions were calculated for both the SU_3 Wigner coefficients and the SU_3 Racah coefficients, which are of particular interest in the recoupling problem involving 2s–1d shell nucleons and basis functions of SU_3 symmetry involving the $SU_3 \supset SU_2$ chain. The Wigner coefficients are those for the Kronecker products $(\lambda_1\mu_1) \times (\lambda_2\mu_2)$, where $(\lambda_1\mu_1)$ is arbitrary and $(\lambda_2\mu_2)$ is the six-dimensional representation (20) of a single 2s–1d shell nucleon or one of the representations (02), (40), (21) for two coupled 2s-1d shell nucleons or the basic eight-dimensional representation (11). The Racah coefficients are those involved in the coupling of two 2s-1d shell nucleons to a function of arbitrary $(\lambda\mu)$. Calculations of SU_3 fractional parentage coefficients are illustrated by a few examples evaluated without recourse to a full chain calculation for representations with large values of λ and μ. The SU_3 fractional parentage coefficients are used to give expressions for single-particle spectroscopic factors for 2s-1d shell nuclei. (auth)

3311 NEUTRON-PROTON INTERACTION AND ALLOWED BETA-DECAY OF G-T TYPE. Ikuko Hamamoto (Tokyo Univ.). Nucl. Phys., 62: 49-74(Feb. 1965).

Allowed beta transitions of G-T type in odd-mass nuclei are investigated from the standpoint of pairing theory. The contribution of the three-quasi-particle states to the nuclear matrix elements is taken into consideration. It is found that admixture of seniority-3 states to the unperturbed seniority-1 state has considerable effect on the matrix element. Such admixture is important to calculate the isotope dependence of the log ft value. For most decays, the magnitude of the experimental log ft value can be obtained with the strength of residual interaction used in the calculation of the magnetic moment. Comparison of the present treatment with the shell model calculation is made and various approximations used are discussed. (auth)

3312 THE $Li^7(p,\alpha)He^4$ REACTION WITH POLARIZED PROTONS IN THE 3.2–5.3 Mev ENERGY RANGE. I. Boca, M. Borsaru, M. Cenja, and E. Iliescu (Inst. for Atomic Physics, Bucharest). Nucl. Phys., 62: 75-80(Feb. 1965).

The ^{7}Li(p,α)^{4}He reaction was studied with polarized protons in the energy range 3.2 to 5.3 Mev at 30 and 50° laboratory angles. Between 4.3 and 5.3 Mev a strong variation of asymmetry in the angular distribution of α particles is present. The variation of asymmetry makes it very difficult to use the ^{7}Li(p,α)^{4}He reaction in a proton polarimeter in the 4.3 to 5.5 Mev energy range. (auth)

3313 THE REACTIONS (p,n) AND (p,pn) INDUCED AT MEDIUM ENERGIES IN LIGHT NUCLEI. L. Valentin (Université de Paris, Orsay, France). Nucl. Phys., 62: 81-102(Feb. 1965). (In French)

The mechanisms of (p,n) reactions were investigated making use of the impulse approximation and of the matrix elements obtained from β decay transitions. Distortion effects are shown to be not very important, at least for energies of about 100 Mev. It is concluded that isobaric-state excitation is preferentially produced. Analysis of these reactions with the optical potential seems to indicate that the charge-exchange term V_1 changes very little with change of incident particle energy and has a value of –120 to 155 Mev. The (p,pn) reactions were interpreted as being produced principally by a direct-surface interaction with an available neutron. On modifying the impulse approximation to take into account the binding energy of this neutron, it is shown that, in first approximation, the absorption coefficient is roughly constant between 50 and 155 Mev. (auth)

3314 ANGULAR CORRELATION OF FISSION FRAGMENTS AND PROMPT γ RAYS FROM SPONTANEOUS FISSION OF Cf^{252}. K. Skarsvåg and I. Singstad (Institutt for Atomenergi, Kjeller, Norway). Nucl. Phys., 62: 103-12 (Feb. 1965).

The angular correlation of fission fragments and prompt γ rays in spontaneous fission of ^{252}Cf was measured for forward and backward angles for γ-ray energies greater than 0.3 Mev. The time-of-flight method was used to eliminate the fission neutrons, and the measurements, were performed with the source on a thick backing and for two geometries, i.e., with the semiconductor detector and the NaI(Tl) scintillation detector on opposite sides of the source. A forward-backward anisotropy in the laboratory system was established. A minimum observed at about right angles in both geometries is significantly larger in the latter geometry. The results can fairly well be accounted for by the assumption that essentially all the γ rays are emitted after the fragments have stopped in the backing, and that the angular distribution in the center-of-mass system is of the type predicted by the statistical model with an anisotropy of –11%. (auth)

3315 OPTICAL MODEL STUDIES OF PROTON SCATTERING AT 30 Mev. IV. ANALYSIS. R. C. Barrett, A. D. Hill, and P. E. Hodgson (Oxford Univ.). Nucl. Phys., 62: 133-44(Feb. 1965).

The experimental differential cross sections, polarizations, and reaction cross sections for the elastic scattering of 30-Mev protons by ^{12}C, ^{16}O, ^{40}Ca, ^{56}Fe, ^{58}Ni, ^{60}Ni, ^{59}Co, Cu, ^{120}Sn, and ^{208}Pb are analyzed using the optical model of the interaction. (auth)

3316 INFLUENCE OF SHELL STRUCTURE AND DYNAMICS OF SEPARATION ON KINETIC ENERGY OF FISSION FRAGMENTS. V. S. Stavinsky and L. N. Shehata (Atomic Energy Establishment, Cairo). Nucl. Phys., 62: 145-52(Feb. 1965).

The kinetic energy of fission fragments is shown to be determined not only by their shape but also by the character of their motion immediately after the rupture of the neck. (auth)

3317 COLLECTIVE EXCITATIONS IN SPHERICAL ODD-MASS NUCLEI. Giu Do Dang (Univ. of Pennsylvania, Philadelphia). Nucl. Phys., 62: 153-64(Feb. 1965).

The random-phase approximation is modified to study the vibrational motion of spherical odd-mass nuclei. It is shown that there is no need to introduce empirical parameters to describe the interaction of the odd particle and the core, but that this interaction may be related naturally to the same hamiltonian that describes the collective motion of even nuclei. The relation with recent work of Kisslinger and Sorensen is also studied; though formally distinct, it is seen that the methods should in practice yield comparable results. The results of de-Shalit's weak-coupling model are seen to be included in the present formulation, which

should be valid, however, for a wider range of interaction strengths. It is also shown how the method can be generalized to take into account higher-order corrections. (auth)

3318 TOTAL NEUTRON CROSS-SECTIONS OF Na, K, AND Ca BETWEEN 4 AND 6 Mev. D. Stuewer, H. Genz, and M. Bormann (Inst. for Experimental Physics, Hamburg). Nucl. Phys., 62: 165-71(Feb. 1965).

Total neutron cross sections in the energy range from 4.2 to 6.2 Mev were measured for sodium, potassium, and calcium using the transmission method. Monoenergetic neutrons are produced via the reaction $D(d,n)^3He$ in a deuterium gas target with the deuteron beam of a 3-Mev Van de Graaff generator. A neutron energy resolution of about 30 kev is achieved. The transmission is measured with a stilbene scintillation spectrometer in steps of about 50 kev. The cross sections clearly exhibit pronounced structures with widths of 100 to 150 kev, which are very probably due to statistical fluctuations of the compound nucleus level density. (auth)

3319 ACTIVATION CROSS SECTIONS FOR REACTIONS OF ARGON WITH 14.7 Mev NEUTRONS. Peter R. Gray, Arlen R. Zander, and Thomas G. Ebrey (Phillips Petroleum Co., Bartlesville, Okla.). Nucl. Phys., 62: 172-6(Feb. 1965).

The (n,α), (n,p), and (n,d) reaction cross sections of ^{40}Ar were measured using 14.7-Mev neutrons. The experimentally determined cross sections are $^{40}Ar(n,\alpha)^{37}S$, 24 ± 2 mb; $^{40}Ar(n,p)^{40}Cl$, 25 ± 2 mb; and $^{40}Ar(n,d)^{39}Cl$, 2.9 ± 0.5 mb. Several of the gamma ray energies in the decay of ^{40}Cl were confirmed. (auth)

3320 SCATTERING OF NEUTRONS OF 14.6 Mev BY SULFUR. M. Conjeaud, B. Fernandez, S. Harar, J. Picard, and G. Souchere (Centre d'Études Nucléaires, Saclay, France). Nucl. Phys., 62: 225-32(Feb. 1965). (In French)

Angular distributions for the scattering cross section of 14.6-Mev neutrons on sulfur were measured by the time-of-flight technique. The measurements included elastically scattered neutrons and two inelastically scattered neutron groups, corresponding respectively to the 2.24-Mev level in ^{32}S and to several levels between 4 and 5 Mev that are not resolved in the experiment. (auth)

3321 INFLUENCE OF PAIRING CORRELATIONS ON E1 TRANSITION PROBABILITIES IN ODD-MASS DEFORMED, RARE-EARTH NUCLEI. Michel N. Vergnes (Laboratoire de Physique Nucleaire, Orsay, France) and John O. Rasmussen. Nucl. Phys., 62: 233-40(Feb. 1965).

Theoretical calculations of E1 and E3 transition rates for deformed rare-earth nuclei are made, taking into account the retarding effect of pairing correlations. It is found that pairing correlation correction factors R improve the general agreement with experiment for one class of transition, viz. E1 with $\Delta K = \pm 1$. However, the factors R generally cause poorer agreement for E1 with $\Delta K = 0$ and for E3 than results from simple use of Nilsson single-particle wave functions with no pairing corrections. The importance of taking into account wave function components admixed by the Coriolis coupling is illustrated by a calculation fitting the many E1 transition rates between two bands in ^{177}Hf. It is further suggested that effects due to three-quasi-particle components (or, in other language, octopole phonon or effective charge effects) are probably of great importance and deserve further study. (auth)

3322 SPINS AND PARITIES OF STATES IN ^{152}Gd. W. Schick and L. Grodzins (Massachusetts Inst. of Tech., Cambridge). Nucl. Phys., 62: 254-66(Feb. 1965). (MIT-2098-58).

The energy level spectrum of ^{152}Gd excited in the beta decay of ^{152}Eu was investigated by the method of directional correlation. Gamma-gamma correlations were performed in triple coincidence with a 4π beta detector, and beta-gamma correlations were performed with a thin lens beta spectrometer. These measurements, together with previously determined internal conversion coefficients, establish the spin and parity of the levels at 755, 1444, and 1604 kev as 4^+, $3^{(+)}$, and 2^-, respectively. (auth)

3323 MODEL ESTIMATES OF THE PROBABILITY FOR TWO-QUANTUM TRANSITIONS OF NUCLEI(III). D. P. Grechukhin (Kurchatov Atomic Energy Inst., Moscow). Nucl. Phys., 62: 273-95(Feb. 1965).

Several simple model estimates are made of the probabilities for two-quantum transitions of nuclei. Formulas for the ratio of probabilities for two-quantum and one-quantum processes in certain nuclear transitions are obtained in the single-particle model with an oscillator potential and $1 \cdot s$ interaction. Separate treatment is given to the ratio $W_{\gamma\gamma}/W_\gamma$ for transitions of the odd nucleus ^{18}Cl and the deformed nucleus ^{167}Er. A scheme of $\gamma\gamma$ transition through the region of giant dipole resonance levels is considered for two-quantum (E1,E1) processes in $0^+ \rightarrow 0^+$ and $2^+ \rightarrow 0^+$ nuclear transitions in the case of even-mass nuclei. Observation of the two-quantum process may in this case furnish information on the matrix element of the correlation function of two protons in the nucleus. A possible effect of the enhancement of $(L,E2)\gamma\gamma$ processes is discussed for odd-mass nuclei in the single-particle model with collective quadrupole excitation of the core. (auth)

3324 ELASTIC SCATTERING OF 1.12 Mev GAMMA RAYS. V. A. Narasimha Murty, V. Lakshminarayana, and Swami Jnanananda (Andhra Univ., Waltair, India). Nucl. Phys., 62: 296-304(Feb. 1965).

Total elastic scattering cross sections of 1.12-Mev gamma rays in elements Pb, Pt, Ta, and Sn are determined with a collimator geometry and a 2 C ^{46}Sc source for scattering angles 20, 30, 45, 60, and 90°. The experimental results are compared with the theoretical computations employing the form-factor formalism of Bethe and the exact formalism of Brown et al. The experimental values of elastic scattering cross sections in Sn show satisfactory agreement with the form-factor values for scattering angles 20, 30, and 45°, while deviations occur for scattering angles 60 and 90°. The values of elastic scattering cross sections for Pb, Pt, and Ta at scattering angles 20, 30, 45, and 90° are in conformity with the exact calculation°. (auth)

337 DECAY OF ^{167}Yb. T. Tamura (Japan Atomic Energy Research Inst. Tokyo). Nucl. Phys., 62: 205-25 (Feb. 1965).

The decay of ^{167}Yb was investigated by means of β- and γ-scintillation spectrometry. A positon emission of 0.2% with the end point energy of 700 ± 70 kev was found to accompany the main electron capture transition from the ground state ($5/2^-(523)$) of ^{167}Yb to the 292.7-kev level ($7/2^-(523)$) of ^{167}Tm. The log ft value for this transition was determined to be 4.63 ± 0.03, which is consistent with an allowed and unhindered characteristic of this transition. A new γ ray of 1050 kev was observed, and a corresponding intrinsic state $5/2^+(413)$ was proposed at the 1230-kev excited state of ^{167}Tm from the cascade relation of the γ rays. Half lives of the 179.4 and 292.7-kev levels were determined to be 1.1 ± 0.1 and 0.9 ± 0.1 μsec, respectively, from fast γ-γ coincidence and delayed γ-γ coincidence experiments. An E2 transition from the 179.4-kev level ($7/2^+(404)$) to the 10.4 kev level ($3/2, 1/2^+(411)$) was established from γ-γ coincidence measuremnets. On the basis of the unified model, a decay scheme is discussed to incorporate the experimental results. (auth)

3326 COLLECTIVE LEVELS IN THE EVEN ISOTOPES OF Cd AND Te. J. A. Cookson (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.) and W. Darcey. Nucl. Phys., 62: 326-36(Feb. 1965).

Energy levels of the mass 110, 112, 114, and 116 isotopes of Cd and the mass 122, 124, 128, and 130 isotopes of Te were studied by inelastic proton scattering. The following new levels were found in the expected energy region of the vibrational triplet: ^{116}Cd, 1371 kev; ^{122}Te, 1175 kev; ^{128}Te, 1496 and 1522 kev; ^{130}Te, 1588 and 1633 kev. It is likely that for the Cd isotopes, the second 2^+ states are below the 4^+ states while for the Te isotopes this ordering is reversed. Of the isotopes considered, only ^{122}Te, ^{112}Cd, ^{114}Cd, and possibly ^{116}Cd appear to have 0^+ states in this region of excitation. The results are compared with available theories of collective nuclei. (auth)

3327 SOME MEASUREMENTS IN THE DECAY OF ^{202}Tl. W. H. G. Lewin, J. Bezemer, and C. W. E. Van Eijk (Laboratorium voor Technische Fysika, Delft, Holland). Nucl. Phys., 62: 337-52(Feb. 1965).

Conversion electron and gamma-ray measurements have shown that the second excited level in ^{202}Hg has an energy of 961 ± 2 kev and a spin assignment of 2^+. A total decay energy of ^{202}Tl of 1214 kev was determined from coincidence measurements between K x rays and gamma rays (440 and 961 kev). This result is in disagreement with the most recent value of 111 ± 20 kev reported by Gupta. The total transition probability to the ground state of ^{202}Hg is 11 ± 2%. This result was obtained from coincidence measurements between K-conversion electrons of the 440 kev transitions and K x rays. (auth)

3328 NEW RARE-EARTH ALPHA EMITTER, ^{148}Eu. K. S. Toth, T. H. Handley, E. Newman, and I. R. Williams (Oak Ridge National Lab., Tenn.). Phys. Rev., 136: B1233-6(Dec. 7, 1964). (ORNL-P-161)

An alpha emitter with a decay energy of 2.63 ± 0.03 Mev was discovered and assigned to ^{148}Eu. The α/E.C. branching ratio was measured to be $9.4 \pm 2.8 \times 10^{-9}$, corresponding to a partial alpha half life of $1.6 \pm 0.5 \times 10^7$ yr. By using a Coulomb barrier penetration formula and the measured alpha-decay energy, a half life of 6.2×10^6 yr was calculated. The agreement, within experimental error, between the measured and calculated partial alpha half lives indicates that the ground-state spin and parity assignments are probably the same for ^{148}Eu and its daughter ^{144}Pm. (auth)

3329 MÖSSBAUER EFFECT STUDIES OF THE 103-kev LEVEL ON Eu^{153}. U. Atzmony, A. Mualem, and S. Ofer (Hebrew Univ., Jerusalem). Phys. Rev., 136: B1237-40(Dec. 7, 1964).

The recoilless absorption spectra of the 103-kev gamma rays from ^{152m}Eu in ^{153}Eu situated in europium oxide and in europium iron garnet were measured at 20°K. The source used was ^{153}Sm in the form of an oxide at 20°K. With the Eu_2O_3 absorber, an unsplit absorption line with 2.1 ± 0.4 mm/sec width at half-maximum was obtained. From the hyperfine Zeeman splittings obtained with the europium iron garnet absorber, a value of +2.01 ± 0.09 nm was found for the magnetic moment of the 103-kev level of the ^{153}Eu. This value is in very good agreement with the predictions of the unified model. (auth)

3330 SHAPES OF ALLOWED AND UNIQUE FIRST-FORBIDDEN β-RAY SPECTRA: In^{114}, K^{42}, Rb^{86}, Sr^{90}, AND Y^{90}. H. Daniel, G. Th. Kaschl, H. Schmitt, and K. Springer (Max-Planck-Institut für Kernphysik, Heidelberg). Phys. Rev., 136: B1240-2(Dec. 7, 1964).

The beta spectra of ^{114}In, ^{42}K, ^{86}Rb, ^{90}Sr, and ^{90}Y (ground-state transitions) were measured with a double-lens spectrometer. The allowed spectrum of ^{114}In was found to have a purely statistical shape; the coefficient b of a possible b/W term turned out to be $0.5 \pm 2.2 \times 10^{-2}$ mc^2. The unique first-forbidden spectra of ^{42}K, ^{86}Rb, ^{90}Sr, and ^{90}Y were found to show very small but definite deviations from the simple unique shape. (auth)

3331 STATES OF NUCLEAR QUADRUPOLE VIBRATIONS AND THE TWO-PHONON TRIPLETS. P. Leal Ferreira, J. A. Castilho Alcaras, and V. C. Aguilera Navarro (Instituto de Fisica Teorica, Sao Paulo, Brazil). Phys. Rev., 136: B1243-6(Dec. 7, 1964).

A complete classification of the states of an n-dimensional isotropic harmonic oscillator is explicitly given in terms of a product of phonon creation operators applied to the "vacuum." The states are labeled by the phonon number and a set of integers associated with rotation subgroups of U_n. For the three-dimensional case it corresponds to the Bargmann-Moshinsky solution. For n = 5 (nuclear quadrupole vibrations), the solution contains Rakavy's seniority. In this case, appropriate linear combinations of the above states are constructed in order to get eigenstates of definite angular momentum. Anharmonic terms of fourth order in the creation and destruction operators breaking down the U_5 symmetry are proposed, in order to account for the existence of the two-phonon triplets. Results of the numerical application for a number of even-even nuclei are given. (auth)

3332 DECAY OF Ce^{143}. K. P. Gopinathan, M. C. Joshi, and E. A. S. Sarma (Tata Inst. of Fundamental Research, Bombay). Phys. Rev., 136: B1247-54(Dec. 7, 1964).

The decay of 33-hr ^{143}Ce was investigated using scintillation and coincidence spectrometers. The analysis of the singles gamma spectrum showed 36- (x ray), 57-, 142-, 232-, 293-, 351-, 450-, 493-, 591-, 668-, 725-, 810-, 885-, 942-, 1045-, 1100-, and 1340-kev gamma rays. All the gamma rays except the 142-kev gamma ray were found to follow a half life of 33 hr. The 142-kev gamma ray, which was thought to be entirely due to ^{141}Ce, was also shown to be present in ^{143}Ce by gamma-gamma coincidences. The 1340-kev gamma ray was newly observed in this investigation. Extensive gamma-gamma coincidences showed the presence of previously unreported weak transitions with energies of 220, 374, 436, 449, 453, 810, and 1045 kev. The level at 493 kev was established and evidence for a new level at 1395 kev was obtained. A revised decay scheme consistent with these observations and the previous beta measurements was presented with excited states in ^{143}Pr at 57, 351, 493, 725, 942, 1160, and 1395 kev. (auth)

3333 NUCLEAR MATRIX ELEMENTS FOR FIRST-FORBIDDEN β DECAY. L. S. Kisslinger and Chi-shiang Wu (Western Reserve Univ., Cleveland). Phys. Rev., 136: B1254-9(Dec. 7, 1964).

The first-forbidden beta decay from the ground states of odd-odd nuclei to the quadrupole vibrational states of even-even nuclei is studied. It is found that the collective motions introduce particle-hole correlations and thereby lead to cancellations, which is the dominant feature of these processes. The region of proton number between 50 and 60 is treated in detail. (auth)

3334 CENTER-OF-MASS CORRECTIONS IN NUCLEAR LEVELS OF NON-NORMAL PARITY. N. Freed and Paul Goldhammer (Univ. of Nebraska, Lincoln). Phys., Rev., 136: B1260-1(Dec. 7, 1964).

A simplified method of constructing shell-model wave functions for states of nonnormal parity is applied to the 1p shell. The center-of-mass motion is confined to the 1s state for oscillator orbitals, as it is for ground states. (auth)

3335 NUCLEAR SPECTROSCOPY WITH A SOFT CORE POTENTIAL. Yeshwant R. Waghmare (Univ. of California, San Diego, La Jolla). Phys. Rev., 136: B1261-5(Dec. 7, 1964).

Nuclear spectroscopic calculations with a potential of the type $v(r) = v_0[(r^n - c^n/r^n)] \exp(-r^2/r_0^2)$ are made for the core radius c = 0.4 F and potential range r_0 = 2.06 F. For simplicity of calculation, n = 2 is assumed. The calculations are made for f, p, and g-shell nuclei. It is shown that in the case of ^{90}Zr the configuration dependence of the effective two-body interaction can be replaced by a singular potential. The configuration interaction in this nucleus is found to depress the ground state 0^+ by ~0.4 Mev and raise the excited 0^+ level by the same amount. For the f and p shells, the level splittings in ^{50}Tl, ^{58}Ni, and ^{10}Be are analyzed. The calculations show that the triplet forces are small for these configurations. (auth)

3336 APPROXIMATE SOLUTION OF A FINITE MANY-PARTICLE SYSTEM WITH TRANSLATIONAL INVARIANCE. [PART] I. Milton O. Vassell, Sidney Borowitz, and Jerome K. Percus (New York Univ., New York). Phys. Rev., 136: B1266-78(Dec. 7, 1964).

A formal technique is developed to study internal properties of finite many-particle systems possessing translational invariance. A method is sought for calculating, in a modified shell model, average values of operators referred to the center of mass, particularly those which have to do with the surface of the system, such as the density of particles. The formalism is based on the method of redundant variables, in which the shell-model wave function describes the internal degrees of freedom of the system, while a superfluous

variable is introduced to satisfy the conservation law and to handle the collective motion. The spurious degeneracy which results from the introduction of the extra variable is removed by suitable subsidiary conditions. Using these restricted solutions, it is shown that the density with respect to the center of mass can be calculated in terms of a one-body operator. The dynamics of the system is then formulated in terms of density matrices suitably defined from these restricted solutions. Within the context of the modified shell model, the density matrices consist of the Dirac density matrices of the shell model plus correction terms which depend nonlinearly on these Dirac matrices and matrix elements of the coordinate X. The single-particle states of the shell model are finally chosen to minimize the expectation of the Hamiltonian. The resulting variational equation contains a homogeneous part which has the structure of the conventional Hartree-Fock equation together with an inhomogeneous term depending nonlinearly on the single-particle states. The solution of this equation is finally expanded about the nontranslationally invariant Hartree-Fock solution to first order in perturbation theory. (auth)

3337 (α,Li^6) REACTION ON C^{12}, N^{14}, Al^{27}, AND Ni AT 42 Mev. Chris D. Zafiratos (Univ. of Washington, Seattle and Los Alamos Scientific Lab., N. Mex.). Phys. Rev., 136: B1279-85(Dec. 7, 1964). (LA-DC-6518)

Angular distributions for the $^{14}N(\alpha,^6Li)^{12}C$ and $^{12}C(\alpha,^6Li) \times {}^{10}B$ reactions were measured at a bombarding energy of 42 Mev. Assuming that the reactions proceed through the pick-up of a deuteron cluster and that the plane-wave Born approximation is applicable, it is found that the reduced width for a deuteron cluster in the ground state of ^{14}N is five times larger than that for the ^{12}C ground state. Distorted-wave Born approximation calculations did not agree with experiment. The (α,^{6}Li) reaction was also observed with Al and Ni targets. Although the (α,^{7}Li) reaction contaminated the spectra and the experimental resolution was insufficient to separate discrete final states, it is clear that the (α,^{6}Li)-reaction cross sections for Al and Ni were smaller than that for Ni by at least a factor of 50 and 1000, respectively. (auth)

3338 SPIN DEPENDENCE OF THE THERMAL NEUTRON CROSS SECTION OF Ho^{165}. R. I. Schermer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 136: B1285-8(Dec. 7, 1964). (BNL-8196)

Transmission experiments were performed with polarized, monochromatic neutrons and polarized ^{165}Ho nuclei, using a single crystal sample of Ho metal. It was determined that $61.0 \pm 2.8\%$ of the thermal capture is into $I - \frac{1}{2} = 3$ states, which establishes the contribution of one or more bound levels to the thermal cross section. Additional measurements on a polycrystalline sample show that the scattering cross section has no appreciable spin dependence. (auth)

3339 NEUTRON AND PHOTON EMISSION FROM DYSPROSIUM AND TERBIUM COMPOUND NUCLEI: RANGE DISTRIBUTIONS. John M. Alexander (State Univ. of New York, Stony Brook and Univ. of California, Berkeley), Jacob Gilat, and David H. Sisson. Phys. Rev., 136: B1289-97 (Dec. 7, 1964). (UCRL-11187)

Electrostatic collection of Tb and Dy recoils stopped in H_2 gas was studied and found to be satisfactory for the study of recoil-range distributions. For the reactions $^{141}Pr(^{12}C, 4n)^{149g}Tb$, $^{146}Nd(^{11}B,8n)^{149g}Tb$, $^{144}Nd(^{12}C,xn)^{156-x}Dy$, (where $x = 5$, 6, or 7), the range distributions are determined by the initial velocity distributions of the recoiling reaction products. The comparison of previously measured angular distributions with the range distributions provides a good method of determining average total neutron energies. The method is relatively insensitive to angular anisotropies $[d\sigma(0°) - d\sigma(90°)]/d\sigma(90°)$ of less than about unity, but can provide clear evidence for strong forward-backward peaking in the angular distribution of the neutrons. The results are consistent with nearly isotropic neutron emission for the latter two reactions, and previously reported neutron energies are supported. Strong forward-backward peaking of the neutrons is indicated for the former two reactions and previously reported neutron energies are corrected by about 20%. (auth)

3340 STUDIES OF Mg^{25}, Mg^{26}, AND Mg^{27} NUCLEI WITH (d,p) REACTIONS. Bibljana Čujec (Univ. of Pittsburgh). Phys. Rev., 136: B1305-24(Dec. 7, 1964).

By irradiating ^{24}Mg, ^{25}Mg, and ^{26}Mg targets with 15-Mev deuterons, the proton spectra were measured at four angles up to high excitation energies of the residual nuclei; as a result many unreported levels of ^{25}Mg, ^{26}Mg, and ^{27}Mg were identified in the region above the neutron separation energy. The 3.969-Mev level of ^{25}Mg and the two unresolved levels of ^{27}Mg at 3.76 Mev and 3.78 Mev have angular distributions characteristic of $l = 3$ angular-momentum transfer, rather than of $l = 2$. Detailed consideration was given to the low-lying levels and to the applicability of the distorted-wave Born approximation method in calculating the single-particle cross sections. From stripping cross sections and related spectroscopic factors, evidence was obtained that the low-lying levels of ^{26}Mg and ^{27}Mg may be considered as members of rotational bands, analogous to those of ^{24}Mg and ^{25}Mg, respectively. (auth)

3341 (d,Li^6) REACTIONS IN C^{12}, O^{16}, AND F^{19} AT 14.6 Mev. W. W. Daehnick and L. J. Denes (Univ. of Pittsburgh). Phys. Rev., 136: B1325-32(Dec. 7, 1964).

It was found that in the bombardment of light targets such as ^{12}C, ^{16}O, and ^{19}F with 14.6-Mev deuterons, many-nucleon transfers often occur with relatively large cross sections. Differential cross sections are presented for the ground-state transitions $^{12}C(d,^6Li)^8Be$, $^{16}O(d,^6Li)^{12}C$, $^{19}F(d,^6Li)^{15}N$, and $^{19}F(d,^9Be)^{12}C$. All angular distributions show pronounced structure. The (d,^{6}Li) reactions leading to the ground states of ^{15}N, ^{12}C, and ^{8}Be show asymmetry with respect to 90°, and have total cross sections on the order of 1–4 mb. The similarity of the angular distributions and a relatively minor sensitivity to energy variations indicate that a direct reaction mechanism predominates. Preliminary distorted-wave Born approximation calculations by Drisko, Satchler, and Bassel show qualitative agreement with the data and support this view. Unique identification of the heavy reaction products was obtained by energy analysis in conjunction with simultaneous analysis of a second parameter, which was either the magnetic rigidity or the time of flight of the heavy ions. Both experimental procedures are described in detail. (auth)

3342 FISSION FRAGMENT ANGULAR DISTRIBUTIONS IN CHARGED-PARTICLE-INDUCED FISSION OF Ra^{226}. J. E. Gindler, G. L. Bate, and J. R. Huizenga (Argonne National Lab., Ill.). Phys. Rev., 136: B1333-44(Dec. 7, 1964).

The angular anisotropy of fission fragments from the charged-particle-induced fission of Ra was measured for protons of 10.5-Mev energy and for deuterons and helium ions in the energy ranges from 14 to 21 Mev and 21 to 43 Mev, respectively. A preliminary calculation of the K_0^2 dependence on excitation energy was made for Th nuclei of mass 226-230 stretched to the saddle point. K_0^2 is the average square of the Gaussian distribution in K, the projection of the total angular momentum on the nuclear symmetry axis. It is shown that the $K_0^2 \propto E^{\frac{1}{2}}$ relation expected on the basis of the Fermi gas model does not hold for excitation energies below some very approximate energy of 16 Mev. Below this energy, a $K_0^2 \propto E$ dependence is consistent with the experimental data. The fission cross sections for Ra with the projectiles mentioned previously were measured. These cross sections were compared with total reaction cross sections calculated on the basis of an optical model with volume absorption. A stepwise increase of the helium-ion-induced fission cross section with projectile energy was interpreted on the basis of multiple-chance fission. Values of Γ_n/Γ_f were determined for various Th nuclei. The magnitude of the "Ra anomaly" of fission is shown to be dependent upon the projectile energy at which measurements are made. (auth)

3343 LOW-LYING LEVELS IN ^{42}Ca EXCITED BY THE ^{43}Ca (d,t) REACTION. J. H. Bjerregaard (Universitet, Copenhagen), H. R. Blieden, O. Hansen, G. Sidenius, and G. R. Satchler. Phys. Rev., 136: B1348-54(Dec. 7, 1964). (ORNL-P-177)

The angular distributions of triton groups corresponding to (d,t) transitions to five states in ^{42}Ca were observed at a bombarding energy of 8.522 Mev. The tritons were recorded

in a multigap broad-range spectrograph. The elastic scattering of deuterons from ^{42}Ca was also measured and fitted with an optical-model potential, which was then used in a distorted-wave analysis of the (d,t) cross sections. The results are in good agreement with the predictions for an $(f_{\frac{7}{2}})^3$ configuration for ^{43}Ca and $(f_{\frac{7}{2}})^2$ for ^{42}Ca, except that the 2^+ parentage is split approximately equally between the 1.53- and 2.44-Mev states of ^{42}Ca. The data do not allow $l = 1$ pickup with more than a few percent of the single-particle strength. Transitions to the second 0^+ state at 1.84 Mev are not observed. The results are discussed in terms of the seniority coupling scheme and in terms of the shell model with residual interactions. (auth)

3344 PROPERTIES OF THE 7.10-Mev LEVEL OF Na^{23}. C. P. Swann (Franklin Inst., Swarthmore, Penna.). Phys. Rev., 136: B1355-9(Dec. 7, 1964).

The 7.1-Mev level of ^{23}Na was studied using the resonance fluorescence technique with the $^{19}F(p,\alpha)^{16}O$ reaction serving as the source of Doppler-broadened radiation. By comparison with the 7.115 ± 0.003-Mev level of ^{16}O the energy was determined to be 7.10 ± 0.02 Mev. The angular distribution of the scattered radiation is consistent only with $\frac{5}{2}$ for the spin. The values allowed for the quadrupole-dipole amplitude ratio, δ, are $-1.8 > \delta > -2.2$ and $2.5 < \delta < 3.0$. Using this spin value and the results of the self-absorption measurement, the partial width for the ground-state transition becomes (0.62 ± 0.07) ev. With the observed branching of 63% to the ground state, the total width becomes 0.98 ± 0.12 ev. This large value of the width combined with the large value of δ defines the parity of the state as positive. (auth)

3345 $Ce^{142}(p,pn)Ce^{141}$ AND $Ce^{142}(p,2p)La^{141}$ REACTIONS FROM 0.4 TO 28 Gev. S. Meloni and J. B. Cumming (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 136: B1359-63(Dec. 7, 1964). (BNL-8105)

The cross sections for the $^{142}Ce(p,pn)^{141}Ce$ and $^{142}Ce(p,2p)^{141}La$ reactions were measured in the energy region from 0.4 to 28 Bev. The (p,pn) cross section decreases to a value of ≈ 50 mb in the Bev region. The (p,2p) cross section shows a significant rise between 0.4 and 1 Bev and then a gradual decrease. Correlations between these data and the total cross sections for p – p and p – n interactions are discussed. (auth)

3346 NUCLEAR BACK SCATTERING IN SOLIDS. IV. THE REACTION $Al^{27}(n,\gamma)Al^{28}$. D. Ertel (Hahn-Meitner-Institut für Kernforschung, Berlin). Nukleonik, 6: 233-5 (Sept. 1964). (In German)

Foil experiments according to the target-capture method gave, for the reaction $^{27}Al(n,\gamma)^{28}Al$ under reactor conditions, an average backscattering range of 4.4 ± 0.3Å in aluminum oxide. Because of the short half life and the small exit probability of the ^{28}Al backscattered atoms the previously used methods were modified and improved. (tr-auth)

3347 NUCLEAR BACK SCATTERING IN SOLIDS. V. THE REACTION $Fe^{56}(n,p)Mn^{56}$. W. Wiechmann, D. Ertel, and K. E. Zimen (Hahn-Meitner-Institut für Kernforschung, Berlin). Nukleonik, 6: 235-7(Sept. 1964). (In German)

For the threshold reaction $^{56}Fe(n,p)^{56}Mn$ with fast reactor neutrons, an average backscattering range of (1.13 ± 0.11) × 10^{-5}cm was found for ^{56}Mn in iron. For the average backscattering range of ^{56}Mn in iron after $^{55}Mn(n,\gamma)$ reactions, a value of about 35Å was obtained. (tr-auth)

3348 SUMMARY OF THE PROPERTIES OF JETS PRODUCED BY HIGH ENERGY NUCLEONS, α-PARTICLES AND HEAVY NUCLEI IN COLLISIONS WITH NUCLEI OF PHOTOGRAPHIC EMULSION. T. Coghen, Z. Czachowska, J. Gierula, et al. (Inst. of Nuclear Research, Krakow). Nukleonika, 9: 257-64(1964).

Multiple meson production in collisions of high-energy nuclei in nuclear emulsions were studied. Particle multiplicities were determined; and angular distributions were measured, together with the energy of the electromagnetic cascade and the energies of some secondary particles. The results indicate that the process of nuclear collision may be treated as a superposition of effects observed in collisions of single nucleons. (D.C.W.)

3349 SUBSEQUENT COLLISIONS OF HEAVY NUCLEI OF HIGH ENERGY. W. Wolter (Inst. of Nuclear Research, Krakow). Nukleonika, 9: 265-9(1964).

Nuclear interactions induced in nuclear emulsion by the fragmentation products of primary heavy nuclei at energies $>10^{12}$ ev/nucleon were investigated by exposing emulsion at 112,000 ft. An event consisting of the gradual breakup of a Z ≃ 15 nucleus at a primary energy of ~2700 Bev/nucleon was observed. The origin and multiplicities of the particles emitted were studied. (D.C.W.)

3350 INELASTICITY COEFFICIENT IN THE NUCLEAR INTERACTIONS OF VERY HIGH ENERGY PARTICLES. J. Massalski, T. Plazak, L. Suszycki, and J. Warczewski (Inst. of Nuclear Research, Krakow). Nukleonika, 9: 319-22(1964).

The inelasticity coefficients for production of mesons (π^0) in lead and graphite were determined using an apparatus containing six trays of ionization chambers and lead and graphite absorbers. The apparatus was installed at 3200 m above sea level. (D.C.W.)

3351 SPIN AND PARITY OF C^{15}. D. E. Alburger, C. Chasman, K. W. Jones, and R. A. Ristinen (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 136: B913-15 (Nov. 23, 1964). (BNL-8174)

The energy of the 5.3-Mev gamma ray produced in the beta decay of ^{15}C was measured with a lithium-drifted germanium detector. An energy of 5.301 ± 0.005 Mev was found, in agreement with the value of 5.299 ± 0.006 Mev found by Alburger, Gallmann, and Wilkinson and verifying the basis of their arguments for the assignment of $\frac{1}{2}^+$ for the spin and parity of the ground state of ^{15}C. The techniques used in the gamma energy determination are discussed in detail. (auth)

3352 PARITY OF ^{11}Be. D. E. Alburger, C. Chasman, K. W. Jones, J. W. Olness, and R. A. Ristinen (Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 136: B916-19 (Nov. 23, 1964). (BNL-8175)

Two measurements were made which are relevant to the parity of ^{11}Be. In one experiment the gamma spectrum from a mixed source of 13.6-sec ^{11}Be and 7.4-sec ^{16}N activities was examined with a 3-mm-thick, lithium-drifted germanium detector having an experimental linewidth of 13 kev for 6-Mev gamma rays. Based on a calibration from lines due to the 6.132- and 7.116-Mev gamma rays in the decay of ^{16}N, the 6.8-Mev gamma ray in the decay of ^{11}Be has an energy of 6.792 ± 0.006 Mev. This is in agreement with the excitation energy of the $\frac{1}{2}^+$ or $\frac{3}{2}^+$ upper member of the 6.752–6.804-Mev doublet in ^{11}B. In the other experiment a magnetic pair spectrometer measurement was made on the ground-state and first-excited-state transitions from the ^{11}B 7.99-Mev level as exctied in the $^9Be(^3He,p)^{11}B$ reaction. It was shown that these transitions are E1, thereby requiring even parity for the 7.99-Mev state, and that the spin of the state is $\frac{3}{2}$. Since the beta transitions of ^{11}Be to the 6.804- and 7.99-Mev levels of ^{11}B are both known to have allowed log ft values, the parity of ^{11}Be is even. (auth)

3353 NUCLEAR TRANSITIONS IN Au^{197}. V. R. Potnis, E. B. Nieschmidt, C. E. Mandeville, L. D. Ellsworth, and D. D. Bornemeier (Kansas State Univ., Manhattan). Phys. Rev., 136: B919-22(Nov. 23, 1964).

The energy of the hardest gamma ray emitted following β decay of the ground state of ^{197}Pt (18 h) was measured with a lithium-drifted germanium detector to be 268 kev, A 279-kev gamma ray was resolved, which decayed in intensity with the 78-min half-life of the isomeric level of ^{197}Pt. The K-shell conversion coefficient of the 191-kev transition was experimentally determined to be 1.59 ± 0.07, suggesting an E0 component and indicating that the spin and parity of the 268-kev level in ^{197}Au are $\frac{1}{2}^+$. Previously reported gamma rays in the decay of these Pt isomers at 155 and 202 kev are shown to arise from the presence of ^{199}Au formed in the β decay of ^{199}Pt. (auth)

3354 SEMIEMPIRICAL NUCLIDIC MASS EQUATION. James Wing (Argonne National Lab., Ill.) and Peter Fong. Phys. Rev., 136: B923-32(Nov. 23, 1964).

Starting from the liquid-drop model, a semiempirical

equation was developed to account for the systematics of the nuclidic masses. The shell effects were included in a correction term. The equation agreed with 842 experimental masses to within ±0.05 Mev in 57% and within ±1.0 Mev in 91%. (D.C.W.)

3355 HYPERFINE STRUCTURE AND NUCLEAR MOMENTS OF 20.4-Min C^{11}. R. A. Haberstroh, W. J. Kossler, O. Ames, and D. R. Hamilton (Princeton Univ., N. J.). Phys. Rev., 136: B932-40(Nov. 23, 1964). (PUC-1964-144)

The hyperfine structure in the $^3P_2$ and $^3P_1$ states of the ground-state configuration of ^{11}C was measured by the atomic-beam, magnetic-resonance technique. The results were used to calculate the nuclear moments of the mirror nucleus, ^{11}B. No signs were determined. (D.C.W.)

3356 ALPHA-DECAY PROPERTIES OF SOME THULIUM AND YTTERBIUM ISOTOPES NEAR THE 82-NEUTRON CLOSED SHELL. Ronald D. MacFarlane (McMaster Univ., Hamilton, Ont. and Univ. of California, Berkeley). Phys. Rev., 136: B941-7(Nov. 23, 1964). (UCRL-11641)

The 84- and 85-neutron isotopes of Tm and Yb were produced by heavy-ion reactions on neutron-deficient, rare-earth targets. These isotopes, which are 16 to 18 neutrons removed from the beta stability line, decay predominantly by alpha emission. A search was made for proton emission in the decay of these nuclides and in ^{151}Tm and ^{152}Tm, but none was observed. The alpha-decay properties of these nuclides were measured and compared with the systematics of alpha decay of the 84- and 85-neutron isotopes. Evidence was obtained for the existence of a long-lived, alpha-emitting isomeric state in ^{154}Tm. (auth)

3357 STATISTICAL THEORY OF NUCLEAR COLLISION CROSS SECTIONS. II. DISTRIBUTIONS OF THE POLES AND RESIDUES OF THE COLLISION MATRIX. P. A. Moldauer (Argonne National Lab., Ill.). Phys. Rev., 136: B947-52(Nov. 23, 1964).

The relation between the statistical properties of the parameters defining the R matrix and the distributions and correlations of the poles and residues of the statistical collision matrix are investigated by means of some limited numerical computations involving models for reactions in the presence of large numbers of competing strongly absorbed channels. The results shed light on the distributions of resonance energies and widths, and on the relation between the partial width to spacing ratios and the channel transmission coefficients. The calculations also yield substantial channel-channel and resonance-resonance correlations in the complex amplitudes which define the collision-matrix pole residues. It is found that the statistical relations depend on the choice of R-matrix boundary conditions; the implications for the choice of boundary conditions are discussed. (auth)

3358 ELASTIC SCATTERING OF DEUTERONS BY LITHIUM-7. J. L. C. Ford, Jr. (California Inst. of Tech., Pasadena). Phys. Rev., 136: B953-60(Nov. 23, 1964).

The elastic scattering of deuterons by ^7Li was investigated from 0.40 to 1.80 Mev. The scattering cross sections tend to be lower than the Rutherford value below about 0.85 Mev, and then rise to several times the Rutherford value for higher energies. A conspicuous anomaly in the scattering cross section occurs near 1 Mev, where the reaction cross sections also show resonances, while there is no prominent scattering anomaly corresponding to the reaction resonances near 0.80 Mev. The apparent presence of broad overlapping energy levels in the compound nucleus, together with the incomplete nature of the data on the various reaction cross sections, prevented a detailed theoretical analysis of the elastic scattering over the energy region investigated. An s-wave analysis, however, provided an adequate fitting of the scattering angular distributions up to about 1 Mev; and the relatively sharp scattering anomaly near 1 Mev appears to be due to p-wave deuterons. (auth)

3359 ELASTIC SCATTERING OF DEUTERONS BY Ca^{40}. R. H. Bassel (Oak Ridge National Lab., Tenn.), R. M. Drisko, G. R. Satchler, L. L. Lee, Jr., J. P. Schiffer, and B. Zeidman. Phys. Rev., 136: B960-70(Nov. 23, 1964).

The elastic scattering from ^{40}Ca of deuterons with energies of 7, 8, 9, 10, 11, and 12 Mev was measured and subjected to optical-model analysis, as a preliminary to a distorted-wave study of the $Ca^{40}(d,p)$ reaction. Considerable ambiguities in the optical-model parameters were found; the results are discussed in detail. Inclusion of a polarization potential and of spin-orbit coupling was found to have little effect. An attempt was made to find a set of parameters that gives a good over-all fit at all the energies. (auth)

3360 $Ca^{40}(d,p)Ca^{41}$, A TEST OF THE VALIDITY OF THE DISTORTED-WAVE BORN APPROXIMATION. L. L. Lee, Jr., (Argonne National Lab., Ill.), J. P. Schiffer, B. Zeidman, G. R. Satchler, R. M. Drisko, and R. H. Bassel. Phys. Rev., 136: B971-93(Nov. 23, 1964).

The reaction $^{40}Ca(d,p)^{41}Ca$ was studied at deuteron energies of 7.0, 8.0, 9.0, 10.0, 11.0, and 12.0 Mev. Absolute differential cross sections for the four most prominent proton groups were measured and compared with predictions based on the distorted-wave Born approximation. Particular emphasis was placed on the ability of this approach to extract precise spectroscopic factors, which for this reaction are expected to be known a priori. Effects of variation of optical parameters, and of inclusion of spin-orbit and finite-range effects, are discussed in detail. It can be concluded that, if optical potentials are used which fit elastic-scattering data, spectroscopic factors can be extracted with an accuracy of 20% or better. (auth)

3361 ELASTIC SCATTERING OF DEUTERONS BY N^{14} FROM 700 TO 2100 kev. R. F. Seiler, D. F. Herring, and K. W. Jones (Ohio State Univ., Columbus). Phys. Rev., 136: B994-1000(Nov. 23, 1964).

The elastic scattering of deuterons by ^{14}N has been investigated over a laboratory energy range from 700 to 2100 kev. Excitation curves were measured for center-of-mass angles of 90.0, 125.3, 140.8, and 166.5°. Angular distributions from 20 to 165° in the center-of-mass system were taken at 200-kev intervals over the entire energy range. Attempts to fit the data with a two-level compound-nucleus scheme were not successful, while optical-model calculations appeared to give a good fit over the entire energy range. (auth)

3362 (α,n) REACTIONS IN SOME ELEMENTS IN THE REGION OF A = 100. Luisa F. Hansen and Marion L. Stelts (Univ. of California, Livermore). Phys. Rev., 136: B1000-5 (Nov. 23, 1964). (UCRL-7885)

Absolute (α,n) cross sections and angular distributions from 0 to 160° were measured for Y, Nb, Rh, Ag, ^{109}Ag, and In, from 12 to 18 Mev. The angular distributions show almost complete isotropy, with a systematic trend toward a forward peaking never larger than 5 to 10%. Since, in these elements, neutron emission is expected to be the main contribution to the reaction cross section, the measured (α,n) cross sections were compared with the predictions of the optical model. Different optical-model potentials for particles were tried. Very good agreement with the experimental results was obtained with the "Igo potential." Reaction cross sections for a square-well potential following Shapiro's calculation for a radius $(1.7A^{\frac{1}{3}} + 1.21)$ F appear to be in the right order of magnitude, but they do not reproduce the dependence of the excitation function on the incident α energy. (auth)

3363 NUCLEAR STRUCTURE INFORMATION FROM THE (p,t) REACTION, A = 46 TO A = 70. G. Bassani, Norton M. Hintz, and C. D. Kavaloski (Univ. of Minnesota, Minneapolis). Phys. Rev., 136: B1006-22(Nov. 23, 1964).

The (p,t) reaction was studied with 40-Mev protons for a sequence of isotopes from Ti to Zn. Angular distributions have been obtained for ground (L = 0) and first-excited-state, or lowest L = 2 group, transitions. The shapes of the angular distributions are nearly identical for a given angular-momentum transfer L. The reaction seems to proceed by the direct pickup of a neutron pair coupled to angular momentum L. Energy spectra of the outgoing tritons were obtained for some of the elements, showing that the predominant strength goes to the lowest L = 0 (usually

the ground state) and L = 2 transitions. The general features of the (p,t) reaction are discussed, showing that the reaction is a powerful tool for studying the angular-momentum coupling of pairs and pair correlation effects. A sketch of the distorted-wave Born-approximation (DWBA) theory for two-nucleon transfer reactions is presented, together with a discussion of the spectroscopic factors predicted by neutron seniority, pairing theory, the degenerate model, and exact shell-model calculations within a pure $f_{\frac{7}{2}}$ configuration. Since reliable DWBA calculations are not available, the integrated cross sections were compared with spectroscopic factors predicted by the various models. The agreement is very good for the L = 0 transitions in the $f_{\frac{7}{2}}$ shell. Appreciable configuration mixing is evident in the $2p-1f_{\frac{7}{2}}$ shell, where both the degenerate model and pairing theory are in qualitative agreement with the data, predicting, however, too rapid a rise with increasing neutron number for the nickel isotopes. The behavior of the lowest L = 2 transitions in the $2p-1f_{\frac{7}{2}}$ shell indicates that the first 2+ states are not very pure in neutron seniority. (auth)

3364 ELASTIC SCATTERING OF C^{12} IONS FROM Fe, Ni, Ag^{107}, In, AND Ta. Jonas Aister (Univ. of California, Berkeley and Univ. of Washington, Seattle) and Homer E. Conzett. Phys. Rev., 136: B1023-30(Nov. 23, 1964).

The angular distributions of ^{12}C ions elastically scattered from Fe, Ni, ^{107}Ag, In, and Ta were measured at an energy of 124.5 Mev. The experimental data were analyzed using a parameterized phase-shift analysis. Very good agreement with experiment was obtained. Precise values for absorption radii, surface parameters, and total reaction cross section could be extracted. (auth)

3365 QUASIFREE ELECTRON-PROTON SCATTERING IN H^3 AND He^3. Arne Johansson (Stanford Univ., Calif.). Phys. Rev., 136: B1030-5(Nov. 23, 1964).

The cross sections of coincidences between scattered electrons and ejected protons were measured in bombardment of ^3He and ^3H with 550-Mev electrons. The variation of the cross section with proton angle and energy was studied at fixed electron angle and energy. The results were compared with calculations based on different three-body nuclear wave functions. (D.C.W.)

3366 GENERAL TECHNIQUE OF QUASIELASTIC SPECTRUM STUDY: APPLICATION TO Be^9. Hoan Nguygen-Ngoc and Jean P. Perez-Y-Jorba (Ecole Normale Superieure, Orsay, France). Phys. Rev., 136: B1036-52(Nov. 23, 1964).

A method was developed by which the electron inelastic cross sections of light nuclei in the first Born approximation can be obtained from experimental quasielastic spectra. The technique was applied to ^9Be, and the corresponding cross sections for its inelastic continuum were obtained. The results were then compared with three theoretical models. (D.C.W.)

3367 EFFECT OF GRAVITY ON NUCLEAR RESONANCE. R. V. Pound and J. L. Snider (Harvard Univ., Cambridge, Mass.). Phys. Rev. Letters, 13: 539-40 (Nov. 2, 1964).

The effect of a gravitational potential difference on the apparent energy of the 14.4-kev γ ray of ^{57}Fe was investigated. The resonance of the 14.4-kev ^{57}Fe γ ray between iron foils was employed. It is concluded that the experiment establishes the validity of the predicted gravitational red shift at the 1% level. (C.E.S.)

3368 ENERGIES OF ISOBARIC MULTIPLETS IN A = 16 AND 20. G. T. Garvey (Princeton Univ., N. J. and Yale Univ., New Haven), Joseph Cerny, and Richard Pehl. Phys. Rev. Letters, 13: 548-9(Nov. 2, 1964). (UCRL-11680)

If the specifically nuclear part of nuclear interactions is charge independent then the energies of the various members of an isobaric multiplet will differ only because of the neutron-proton mass difference and the electromagnetic interactions among the protons. These electromagnetic contributions are calculable and could be removed; the remaining masses of the multiplets thus could be examined with regard to charge independence in nuclear forces. It was previously shown that to first order in the Coulomb energy that the masses within an isobaric multiplet are characterized by $M(A,T,T_z) = a(A,T) + b(A,T)T_z + c(A,T)T_z^2$, where M is the mass of a member of the multiplet, A is the number of nucleons, T is the isobaric spin, and $T_z = \frac{1}{2}(N-Z)$; a(A,T), b(A,T), and c(A,T) are taken as constants within a given multiplet. The constants a, b, and c were determined and compared for A = 16 and 20. The isobars ^{16}O, ^{16}N, ^{16}F, ^{20}Ne, ^{20}Na, and ^{20}F are discussed. (C.E.S.)

3369 EXPERIMENTAL OBSERVATION OF ELECTRIC-QUADRUPOLE HYPERFINE EFFECTS IN MUONIC X-RAY SPECTRA. R. D. Ehrlich (Univ. of Chicago), R. J. Powers, V. L. Telegdi, J. A. Bjorkland, S. Raboy, and C. C. Trail. Phys. Rev. Letters, 13: 550-3(Nov. 2, 1964).

The muonic L and K x rays from a number of heavy elements were studied, and quantitative evidence for the effects due to the hyperfine coupling between the muon charge cloud and the nuclear quadrupole moment was obtained. X-ray spectra of ^{238}U, ^{232}Th, natural lead (52% ^{208}Pb), and ^{209}Bi were discussed. (C.E.S.)

3370 POSSIBLE EXISTENCE OF A p-He^3 RESONANCE WITH Q = 11 Mev PRODUCED IN $_\Lambda He^4$ DECAY. M. J. Beniston, B. Krishnamurthy, R. Levi Setti, and M. Raymund (Univ. of Chicago). Phys. Rev. Letters, 13: 553-5(Nov. 2, 1964).

An effect in the π^--energy histogram from $_\Lambda He^4$ decay in nuclear emulsions was observed and is best interpreted as evidence for an excited state of ^4Li, 10.62 ± 0.20 Mev above decay to proton and ^3He. The width observed is 0.23 ± 0.20 Mev, which agrees with the meson (π^-) energy resolution (~0.40 Mev) in nuclear emulsions only if the upper limit (0.43 Mev) is taken. (C.E.S.)

3371 ISOBARIC MASS FORMULA IN THE 1p SHELL. D. H. Wilkinson (Brookhaven National Lab., Upton, N. Y. and Oxford Univ.). Phys. Rev. Letters, 13: 571-3(Nov. 9, 1964).

A formula relating the masses within an isobaric multiplet is investigated, with particular consideration of the Coulomb energies in light nuclei. (D.C.W.)

3372 CALCULATION OF NUCLEON-DEUTERON SCATTERING AND THE TRITON BINDING ENERGY. R. Aaron (Northeastern Univ., Boston and Univ. of California, Livermore), R. D. Amado, and Y. Y. Yam. Phys. Rev. Letters, 13: 574-6(Nov. 9, 1964).

The triton binding energy, the angular distribution for n-d scattering, and the doublet and quartet scattering lengths were calculated, extending the exact three-body theory to include spin-dependent two-body forces. The calculation is described, and the results are presented and compared with experimental and theoretical values. (D.C.W.)

3373 PROBABILITY OF LARGE NEUTRON-CAPTURE CROSS SECTIONS. D. R. Harris (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 242(Nov. 1964).

3374 TWENTY-SIX-GROUP CROSS SECTIONS. D. M. O'Shea, H. H. Hummel, W. B. Loewenstein, and D. Okrent (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 242-3(Nov. 1964).

3375 ATOMICS INTERNATIONAL AUTOMATED CROSS SECTION PROGRAM. H. Alter and H. J. Lorenzi (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 243-4(Nov. 1964).

3376 CALCULATED FAST NEUTRON CAPTURE CROSS SECTIONS FOR TANTALUM-181, TUNGSTEN-182, TUNGSTEN-183, TUNGSTEN-184, AND TUNGSTEN-186, A. Prince (General Electric Co., Cincinnati). Trans. Am. Nucl. Soc., 7: 244(Nov. 1964).

3377 THE EFFECT OF SPIN CORRELATIONS UPON NEUTRON SCATTERING BY METHANE. P. Michael (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 244-5(Nov. 1964).

3378 CALCULATION OF THE COLD-NEUTRON SCATTERING CROSS SECTION OF LIQUID HYDROGEN USING A CONSISTENT VIBRATION LIQUID MODEL. H. G. Carter (General Dynamics/Fort Worth, Tex.). Trans. Am. Nucl. Soc., 7: 245-6(Nov. 1964).

3379 GRAPHITE SCATTERING KERNEL. R. G. Bardes and J. A. Young (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 246(Nov. 1964).

3380 INCREASE IN THE NEUTRON EMISSION RATES OF PLUTONIUM–BERYLLIUM SOURCES. M. Edward Anderson (Monsanto Research Corp., Miamisburg, Ohio). Trans. Am. Nucl. Soc., 7: 246-7(Nov. 1964).

3381 SOME ELASTIC NEUTRON ANGULAR DISTRIBUTIONS. A. Smith and P. Guenther (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 267(Nov. 1964).

3382 MEASUREMENTS OF 14-Mev INELASTIC NEUTRON CROSS SECTIONS BY A DOUBLE SCINTILLATOR PROTON RECOIL SPECTROMETER. Sol Pearlstein (Rensselaer Polytechnic Inst., Troy, N. Y.). Trans. Am. Nucl. Soc., 7: 267-8(Nov. 1964).

3383 ZIRCONIUM AND IRON-54 (n,p) CROSS SECTION MEASUREMENTS. E. E. Carroll, Jr., G. G. Smith, and R. W. Stooksberry (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 268-9(Nov. 1964).

3384 AN INVESTIGATION AT A TECHNIQUE FOR MEASURING THE FISSION AND CAPTURE CROSS SECTIONS OF URANIUM-233 AND PLUTONIUM-239. R. Gwin (Oak Ridge National Lab., Tenn.), G. deSaussure, L. W. Weston, E. Haddad, and W. M. Lopez. Trans. Am. Nucl. Soc., 7: 269-70(Nov. 1964).

3385 MEASUREMENTS OF THE VARIATION OF THE RATIO OF THE CAPTURE AND FISSION CROSS SECTIONS OF URANIUM-235. L. W. Weston (Oak Ridge National Lab., Tenn.), G. deSaussure, R. Gwin, J. E. Russell, and R. W. Hockenbury. Trans. Am. Nucl. Soc., 7: 270(Nov. 1964).

3386 THERMAL-NEUTRON CROSS SECTION AND RESONANCE CAPTURE INTEGRAL OF NEODYMIUM-148. C. P. Ruiz, J. P. Peterson, Jr., and B. F. Rider (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 7: 270-1(Nov. 1964).

3387 A MEASUREMENT OF ALPHA FOR URANIUM-233 AND URANIUM-235 IN THE EPITHERMAL REGION. L. J. Esch and F. Feiner (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nucl. Soc., 7: 272(Nov. 1964).

3388 DOPPLER EFFECT IN URANIUM-238 CAPTURE AND URANIUM-235 FISSION IN A FAST NEUTRON SPECTRUM. R. Sher (Stanford Univ., Calif.) and G. R. Pflasterer, Jr. Trans. Am. Nucl. Soc., 7: 272-3(Nov. 1964).

3389 DOPPLER BROADENING OF RESONANCES BY SAMPLE MOTION. Charles E. Till (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 273-4(Nov. 1964).

3390 MODIFIED RATIONAL APPROXIMATION TO THE COLLISION PROBABILITY IN LUMPED RESONANCE ABSORBERS. J. M. Otter (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 275(Nov. 1964).

3391 INVESTIGATION OF THE RADIATIVE CAPTURE OF NEUTRONS WITH ENERGIES UP TO 50 kev. Yu. P. Popov. Tr. Fiz. Inst., Akad. Nauk SSSR, 24: 111-68 (1964).

The energy dependence of the radiative capture cross sections for Cu, Fe, Pb, and Ni was determined, and the measured resonance integral of the capture cross section was compared with calculated and previous experimental values. The average cross sections for Br, Rb, Nb, Mo, ^{98}Mo, ^{100}Mo, Rh, Ag, In, I, Cs, W, Ir, and Au were obtained; and the energy dependence of the radiative capture cross sections for these nuclei were plotted. Resonance integrals were tabulated. The dependence of the average cross section for 30-kev neutrons on the atomic weight of odd-z nuclei was determined, and the average cross section was analyzed on the basis of the interaction of p-neutrons with nuclei. The capture cross section was calculated; the experimental and theoretical values were compared. The average cross sections were also analyzed. (D.C.W.)

3392 NEW CALORIMETRIC DETERMINATION OF THE HALF LIFE OF RaD(^{210}Pb). H. Ramthun (Physikalisch-Technische Bundesanstalt, Brunswick). Z. Naturforsch., 19a: 1064-9(Sept. 1964). (In German)

The half life of ^{210}Pb was evaluated from calorimetric measurements of the specific rate of energy emission of two radium sources with different ages of enclosure. The result, $\tau = 21.96$ years, agreed well with the value, recommended in 1931 by the international radium standard commission. The uncertainty (threefold standard deviation) of the result amounts to ± 0.51 year. (auth)

3393 THE SHAPE OF THE ALLOWED POSITRON SPECTRUM OF Na^{22}. W. H. Brantley, W. B. Newbolt, and J. H. Hamilton (Vanderbilt Univ., Nashville). Z. Physik, 181: 196-205(1964).

The shape of the allowed positron spectrum from the decay of ^{22}Na was studied under various experimental conditions in an iron-free, double-focusing spectrometer in search of instrumental distortions of the spectrum. The possibility of positrons back-scattering from the material directly behind the source on the optical path of the positrons was studied. The beta spectrum shape was measured with end-plates (located ~6.5 cm behind the source) of aluminum, lucite, and lead. Different spectrometer baffle settings were also used. No differences were observed in the spectrum shapes taken under the different experimental conditions. The experimental shape factor could be fitted with an empirical shape of the form of $(1 + b/W)$ with $0.10 \lesssim b \lesssim 0.3$ in agreement with earlier work. (auth)

Plasma Physics and Thermonuclear Processes

Refer also to abstract 3150.

3394 (AD-602039) LONG WAVELENGTH OSCILLATIONS OF A QUANTUM PLASMA IN A UNIFORM MAGNETIC FIELD. [PART] II. Technical Report 22. Vittorio Celli and N. David Mermin (California, Univ., San Diego, La Jolla). June 17, 1964. Contract Nonr-2216-(11). 42p. $1.25(OTS).

The self-sustained oscillations of a quantum mechanical electron gas in a uniform magnetic field are discussed in the time-dependent Hartree approximation, or random-phase approximation. The full electromagnetic interaction between electrons is taken into account, and spin effects are included. The resulting dispersion relation reduces to the Appleton-Hartree equation of classical magnetohydrodynamics in the limit of long wavelengths. It is found that this classical equation holds even for a highly degenerate electron gas or for magnetic fields so strong that only a few Landau oscillator levels are appreciably occupied. The validity of long wavelength expansions is discussed for the various normal modes, particular attention being given to the low-frequency transverse mode, a particular case of which is the helicon or whistler. It is also shown that the normal modes with appreciable longitudinal currents are correctly described over a wide range of wavelengths by the electrostatic approximation, in which only Coulomb forces between electrons are retained. (auth)

3395 (AD-606894) AN EXPERIMENTAL AND THEORETICAL STUDY OF MHD IONIZING FRONTS. Research Report No. 188. R. M. Patrick and E. R. Pugh (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Sept. 1964. Contract AF49(638)-1129. 36p. $2.00 (OTS).

An experimental and theoretical description of ionization fronts propagating into hydrogen with a bias magnetic field in the plane of the front is presented. The experimental evidence showed that the absolute light intensity behind the

front corresponds to a fully ionized plasma. The density ratio was obtained by measuring the magnitude of the current in the front, the front speed, and using the equation of mass and momentum. The front speeds are small compared to the Alfven velocity and are characterized by a critical velocity, U_c, where U_c is the velocity a molecule must have so the kinetic energy equals the energy necessary to ionize it. A theory for the ionization front was developed that neglects the plasma pressure and abandons the condition $E = V \times B$ both ahead and behind the front. The theory predicts the front velocity and the rather unusual variation of the density ratio across the fronts with the front speed. (auth)

3396 (MATT-222) ON THE PRODUCTION OF AN ENERGETIC PLASMA BY MEANS OF HIGH-ENERGY, SHORT-DURATION LASER PULSES. John M. Dawson (Princeton Univ., N. J. Plasma Physics Lab.). Sept. 18, 1963. Contract AT(30-1)-1238. 24p. (CONF-471-43). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Physical Society 5th Annual Meeting, San Diego, Calif., Nov. 1963.

Calculations are presented showing that a laser pulse delivering powers of the order of 10^{10} watts to a liquid or solid particle with dimensions of the order of 10^{-2} cm will produce a hot plasma with temperatures in the range of several hundreds of ev. To a large extent the plasma temperature is held down by its rapid expansion and cooling. This converts much of the energy supplied into ordered energy of expansion. This ordered expansion energy can amount to several kev per ion. If the expanding plasma can be caught in a magnetic field and its ordered motion converted to random motion this might be utilized as a means for filling controlled thermonuclear fusion devices with hot plasma. Further, it should also be possible to do many interesting plasma experiments on such plasmas. (auth)

3397 (MATT-285) A BIBLIOGRAPHY ON MAGNETIC DIFFUSION AND DRIFT INSTABILITIES. Francis F. Chen (Princeton Univ., N. J. Plasma Physics Lab.). June 1964. Contract AT(30-1)-1238. 28p. Dep.; $2.00 (cy), 1(mn) OTS.

A bibliography is presented, consisting of 162 references to material on magnetic diffusion and drift instabilities in plasma. (T.F.H.)

3398 (NASA-CR-104) THE PROBABILITY OF COLLISION FOR MOMENTUM TRANSFER OF SLOW ELECTRONS IN A NITROGEN PLASMA AFTERGLOW. Joseph Ajello (Rensselaer Polytechnic Inst., Troy, N. Y.). Oct. 1964. 58p. $1.50(OTS).

The purpose of the experiment was to measure the probability of collision for momentum transfer of slow electrons in a weakly ionized nitrogen plasma afterglow. The probability of collision was calculated in the late afterglow on the basis of a hard sphere model interaction between electrons and neutrals. The value obtained over the energy range 0.040 to 0.078 ev is 18.1 ± 1.6 (cm torr)$^{-1}$. The time taken by the electron gas to relax from the high temperature of the active discharge to room temperature and to a Maxwellian distribution is found to be much longer than that predicted by a consideration of elastic collisions between electrons and neutrals. As expected, the rate of relaxation to room temperature and to a Maxwellian distribution is a sharp function of pressure. The reason for these effects is ascribed to the disturbance of the afterglow by interactions involving metastable nitrogen particles. (auth)

3399 (UCRL-7660-T) THE COMPUTATION OF SELF-CONSISTENT POTENTIAL DISTRIBUTIONS IN A COLLISIONLESS PLASMA. Laurence S. Hall (California. Univ., Livermore. Lawrence Radiation Lab.). Jan. 6, 1964. Contract W-7405-eng-48. 10p. (CONF-471-39). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Physical Society 5th Annual Meeting, San Diego, Calif., Nov. 1963.

The problem of obtaining the self-consistent potential distributions about an electrode in an infinite collisionless plasma in the absence of a magnetic field was considered. In such a plasma, the charge density, which appears on the right of Poisson's equation, can be expressed as a complicated integral functional of the whole potential distribution and of the electron and ion velocity distributions at infinity. Because of the tendency of a plasma toward near charge neutrality everywhere except in sheath regions near physical boundaries, subtraction problems make it exceedingly difficult to integrate the equations numerically in terms of the boundary condition at infinity. A technique was devised which allows one to obtain a self-consistent solution iteratively by a method based on an integral form of Poisson's equation, using the boundary condition at infinity. The method is especially useful in application to the theory of the electrostatic probe, as it avoids the alternative of introducing an artificial semi-quantitative boundary condition at the sheath edge, and can be used to obtain a potential distribution and associated parameters, accurate to within about 5% of critical quantities, in less than 1 hour of IBM 7094 computation time. (auth)

3400 (UCRL-12053) RESONANCES OF A MICROWAVE CAVITY PARTIALLY FILLED WITH A LOSSY PLASMA. J. L. Shohet (California. Univ., Livermore. Lawrence Radiation Lab.). Aug. 27, 1964. Contract W-7405-eng-48. 11p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A cylindrical microwave cavity containing a concentric plasma column can be resonated in an infinite number of electromagnetic wave modes. If collisions are neglected, the resonances all shift upward towards coaxial cavity modes as the electron density in the plasma is increased. The characteristic eigenvalue equation for all modes including collisional effects is derived and typical graphs for fundamental modes are presented. The equation has complex roots; the empty cavity mode and the coaxial (infinite electron density) mode, which are originally overcoupled, uncouple from each other for sufficiently large values of electron collision frequency. The result is first an increase, then a decrease to below the empty cavity resonant frequency, and finally an increase for the real part of the root of the characteristic equation. The imaginary parts of the roots, which are inversely proportional to the Q of the plasma cavity system, show the two modes distinctly. (auth)

3401 (UCRL-12057-T) MICROWAVE EXCITATION OF THE P-3 PLASMA DEVICE AT THE ELECTRON CYCLOTRON FREQUENCY. J. L. Shohet and J. F. Steinhaus (California. Univ., Livermore. Lawrence Radiation Lab.). Aug. 27, 1964. Contract W-7405-eng-48. 16p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The P-3 "Puffatron" device was operated in conjunction with a microwave signal at the electron cyclotron frequency. Two wavelengths were used. They were 8 mm and 3 cm (X-band). The 3 cm radiation was pulsed at 40 kw for 2 μsec, while the 8 mm radiation was operated continuously at 15 w. The most striking results were obtained with the 3 cm radiation; when the radiation was applied during the afterglow of the Puffatron discharge, a burst of light and a signal on a capacitance probe was observed. The report is preliminary and final analysis of the data will be performed subsequently. (auth)

3402 FORMATION OF ION BEAMS FROM PLASMA SOURCES: PART I. J. Hyman, Jr., W. O. Eckhardt, R. C. Knechtli, and C. R. Buckey (Hughes Research Labs., Malibu, Calif.). AIAA (Am. Inst. Aeron. Astronaut.) J., 2: 1739-48(Oct. 1964).

The basic mechanisms involved in ion beam formation from plasma-type ion sources were investigated. Theoretical concepts and their verification by experiments with an electron-bombardment ion source (hot-cathode Penning discharge) are described. The conditions determining the position of the plasma boundary in an ion extraction system were established quantitatively. It was demonstrated that the plasma boundary can be simulated in an electrolytic tank, making this powerful tool applicable to the design of ion-optical systems for plasma-type sources. It was shown that a careful electrode design is required to avoid direct interception, and that the remaining charge-exchange interception can also be reduced substantially by ion-optical means, particularly by using systems with high perveance and by employing an

additional "diverter" electrode. The concept of "perveance-density matching" was introduced in order to accommodate a nonuniformity of the ion current density available from a plasma-type source, and the effectiveness of this principle was demonstrated. (auth)

3403 GRAVITATIONAL INSTABILITIES IN A COMPRESSIBLE COLLISIONAL PLASMA LAYER. Bruno Coppi (Stanford Univ., Calif.). Ann. Phys. (N. Y.), 30: 178-200 (Oct. 20, 1964).

The stability of a plasma layer under the influence of a gravitational field, in conditions where all the dissipative effects due to collisions are important, is investigated by proper asymptotic methods. Small ratios of the kinetic to the magnetic pressure and regimes where the ion Larmor radius effects are not relevant are considered. In these conditions, by comparing the heat diffusion rate due to ion-ion collisions with the mass diffusion rate due to ion-electron collisions, the fastest gravitational modes are found to be isothermal or adiabatic. Therefore, except for a particular set of equilibrium configurations which are examined, the compressibility of the system plays an essential role. As a consequence, the perturbed electric field, associated with the resistivity and the current transverse to the magnetic field, directly enters the stability problem and has the effect of restraining the material from crossing the lines of force. The conditions where stability is possible are then derived. Proper variational methods are given and used in order to determine conditions for marginal stability or growth rates when simple analytic solutions are not available. (auth)

3404 A ZEBRA-STRIPE DISPLAY FOR AN OPTICAL INTERFEROMETER, AND ITS USE TO MEASURE PLASMA DENSITY IN THE PRESENCE OF VIBRATION. A. Gibson and G. W. Reid (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Appl. Phys. Letters, 5: 195-7 (Nov. 15, 1964).

A method is described which gives an unambiguous indication of reversals of the direction of optical path changes and permits estimation of fractions of a fringe shift on a linear scale, as well as correction for spurious vibration. The method was used to measure the plasma refractive index in ZETA in which frequent path length reversals due to irregular density fluctuations occur, as well as vibrational changes in path during the discharge. (D.C.W.)

3405 THEORETICAL BASIS FOR "MINIMUM PRINCIPLES" FOR THE POTENTIAL OF A GAS DISCHARGE AND A FURTHER INFERENCE. Max Steenbeck (Institut für Magnetohydrodynamik, Deutsche Akademie der Wissenschaften, Jena, Ger.). Beitr. Plasmaphysik, 1: 1-10 (1960-61). (In German)

A "stationary" process can be described by a differential equation with a sufficient number of boundary conditions for solution, without the processes actually occurring as indicated by the calculation. In part, boundary conditions can be considered, which have only a very weak influence on stationary balance (of energy, particle number, etc.). An infringement of such conditions basically makes the process unstationary, nevertheless the combined vibrations for infringement of only weakly acting stationary conditions are smaller than the practically or principally present vibrations of each "real" stationary size; then such a quasi-stationary process is no longer distinguishable from a real stationary process. A quasi-stationary process can be derived with regard to all boundary conditions giving solutions for the differential equation. The actually occurring processes are determined by means of a stability criterium, which does not result from the differential equation for a stationary state, but must be introduced. The theoretical consideration for use of minimum principles for the combustion potential of an arc discharge is discussed. (tr-auth)

3406 THE POSITIVE COLUMN OF ARGON LOW-PRESSURE DISCHARGE IN THE TRANSITION REGION. [PART] I. Karl Wojaczek (Physikalisch-Technisches Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 30-43(1960-61). (In German)

From probe measurements in the positive column of an argon low-pressure discharge, the electron temperature was determined in the extended current intensity regions of the axial potential gradient as well as in the homogeneous column. A comparison was made between the measured and theoretical values. The roles of different elementary processes in the discharge were estimated. In the transition region between the homogeneous and the layered column, artificial moving layers of small amplitude were excited and their dispersion relation measured for various pressures. The experimentally determined frequency dependence of layer width and amplification could be represented by a simple analytical expression. The results obtained made possible a quantitative check of the theory of moving layers. (tr-auth)

3407 APPLICABILITY OF THE PRINCIPLE OF EXTREME ENTROPY PRODUCTION FOR STATIONARY CURRENT CONDUCTING PROCESSES. Fritz Krause and Max Steenbeck (Institut für Magnetohydrodynamik, Deutsche Akademie der Wissenschaften, Jena, Ger.). Beitr. Plasmaphysik, 1: 65-81(1960-61). (In German)

An investigation was made to determine if the current field appearing in a stationary conducting process can be ascertained from the extremes of heat or entropy production. Only for spatially dependent conductivity was this the case; but if the conductivity also depended on the value of the field strength, this possibility no longer generally persisted. In certain cases the total resistance can be reduced for a direct current if current-isolating walls are placed as barriers. (tr-auth)

3408 DEPENDENCE OF ELECTRON MOBILITY IN MERCURY ON THE TEMPERATURE. Herbert Burck (Physikalisch-Technische Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 82-93 (1960-61). (In German)

From measurements of the absolute temperature course in conventional mercury high-pressure lamps, the electron mobility was calculated. For this the canal model was used. The mobility proved to be strongly temperature dependent. Two ways to explain this are proposed. The mean free path was calculated from 3 cross sections: the gas-kinetic cross section of the mercury atom, the Gvosdover cross section of the mercury ion, and the cross section for excitation of the mercury atom by electron bombardment. The transport cross section of the ions as opposed to electrons was 1 to 2 orders of magnitude greater than that calculated by the formula given by Gvosdover. (tr-auth)

3409 CALCULATION OF THE THERMODYNAMIC CONSTANTS OF ISOTHERMAL HYDROGEN PLASMA. Ferd. Kuemmel (Physikalisch-Technisches Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 94-106(1960-61). (In German)

Calculations were made of some thermodynamic characteristic values of the atomic, isothermal hydrogen plasma. The temperature limits of the investigation lay between 10000 and 50000°K, the pressure limits between 1 and 10000 torr. For transfer of the results to deuterium and tritium, uniformly effective ionization potentials were adopted, so that the calculated differences for hydrogen depended only on the difference of the masses. The results are presented in tables and graphs. (tr-auth)

3410 TOTAL RADIATION OF STATIONARY- AND PULSE-MODULATED ARGON HIGH-TEMPERATURE ARCS. Werner Neumann (Physikalisch-Technische Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 107-18(1960-61). (In German)

The total radiation output of an argon high-temperature arc was determined as a function of the absolute arc output. Measurements were made of the total radiation energy emitted when the stationary arc current is overlapped by a pulse current, which is produced by a condenser battery. This radiation energy, as a function of the pulsed electric energy changed in the arc, which was measured with a ballistic watt-second-meter, is recorded in a graph. The arc characteristics at high current strengths and radial temperature distributions in stationary arcs are given. (tr-auth)

3411 DETERMINATION OF THE CONSTANTS OF A PLASMA BEAM EMITTED INTO THE OPEN ATMOSPHERE. Werner Neumann (Physikalisch-Technische Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 119-25(1960-61). (In German)

The power, which, as heat, leads to an argon plasma beam issuing from a plasma beam generator, was determined as a function of the electric power and the amount of gases flowing through the electrode opening per unit of time. The plasma volume, the effective plasma temperature, the maximum temperature, and the total radiation output of the plasma beam were determined as functions of the same parameters. (tr-auth)

3412 NOISE IN LOW-PRESSURE PLASMA. Karl Wojaczek (Physikalisch-Technisches Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 127-36(1960-61). (In German)

For the local influencing of a xenon low-pressure discharge by means of a pulse-operating auxiliary discharge, a disturbance propagating in the positive column was observed by photoelectric methods and was interpreted as rare gas noise. This interpretation was indicated by the size of the propagation velocity and its independence from current direction, frequency, and gas pressure. The noise production results chiefly from pulsed heating of the rare gas in the region of the auxiliary discharge. By the noise-conditioned modulation of the light emitted by the discharge, the variations of electron temperature influenced by the relaxation effect are affected. The slight variations of the noise rate with the discharge current strength could be traced by the changes caused in the rare gas temperature. According to preliminary measurements damping of the sound increased with increasing discharge current strength, which indicated a certain influence of the degree of ionization of the low-pressure plasma on the sound propagation. (tr-auth)

3413 ELECTRICAL BREAKDOWN OF ARGON UNDER HIGH PRESSURE. Gunther List (Physikalisch-Technisches Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 137-52(1960-61). (In German)

For breakdown field strengths of over 10^5 v/cm in compressed gases, deviations from Paschen's law were observed. The breakdown voltage of argon for pressures up to 300 atm and for the various electrode metals used were measured. The deviation of the breakdown voltage was characterized by a constant c, which is dependent on electrode material, the characteristics of the cathode surface, and on the quotients of breakdown field strength and gas pressure. The breakdown at high pressure was explained as a field emission breakdown, in which the necessary field strength is produced by accumulation of the positive gas ions on the oxidized cathode surface. With the charging of the cathode surface a charge equalization occurred because of the conductivity of the oxide layer in competition. The two processes together explain the size of the deviation constant c. From the equilibrium of both processes a condition for the static breakdown voltage was derived. (tr-auth)

3414 THEORY OF CATHODE FALLS. [PART] I. E. Hantzsche (Physikalisch-Technisches Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 179-201(1960-61). (In German)

The characteristics of cathode falls and experimental principles for studying them are described. A graph of potential, field strength, and space charge in the cathode fall is presented. The "trivial" equations, motion equations and elementary processes, equilibrium equations and production of charge carriers, and boundary layer processes and stationarity conditions are reviewed. (M.C.G.)

3415 THEORY OF CATHODE FALLS. [PART] II. E. Hantzsche (Physikalisch-Technisches Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 203-35(1960-61). (In German)

The field distribution for a cathode fall, extremity principles and the normal cathode fall, radiation from a glow discharge, two-dimensional systems, and velocity distributions are discussed. Equations to be developed in a theory for cathode falls are described. (M.C.G.)

3416 STATE CHANGES IN ISOTHERMAL ARGON PLASMA. Ferdinand Kuemmel (Physikalisch-Technisches Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 236-44(1960-61). (In German)

Calculations were made and graphs drawn, which deal with the possible thermodynamic state changes of a flowing argon plasma in the pressure and temperature regions $10 < p < 3 \times 10^6$ dynes/cm^2 and $5000 < T < 26000$°K. (tr-auth)

3417 BEHAVIOR OF ELECTRONS IN LOW-PRESSURE PLASMA. R. Rompe, S. Ullrich, and H. Wolff (Physikalisch-Technisches Institut, Deutsche Akademie der Wissenschaften, Berlin). Beitr. Plasmaphysik, 1: 245-9(1960-61). (In German)

Electron interactions in plasmas at pressures between 10^{-4} and 10^{-1} torr and electron concentrations of 10^{18} to 10^{12} cm^{-3} were considered. Two mechanisms were observed: thermal boundary layer vibrations and coherent stopping. Quantitative descriptions of observed anomalous scattering were developed. (M.C.G.)

3418 PHENOMENOLOGICAL DESCRIPTION OF A DIFFUSION-DETERMINED COLUMN PLASMA. Johannes Wilhelm (Institut fur Gasentladungsphysik, Deutsche Akademie der Wissenschaften, Greifswald, Ger.). Beitr. Plasmaphysik, 1: 250-75(1960-61). (In German)

The description of a plasma in the so-called diffusion-determined region is considered. The situation is covered with the help of the concepts of the diffusion coefficient and mobility. The resulting equation system is presented. Conditions for the existing proportional distribution are listed. A possible general solution is given for the case of proportional concentration distribution. (M.C.G.)

3419 THEORY OF THE RESONANCE PROBE. André Messiaen (Centre d'Etudes Nucleaires, Saclay, France). Compt. Rend., 259: 1710-13(Sept. 7, 1964). (In French)

A general treatment of the resonance probe is outlined, based on the quasi-static and equivalent-permittivity approximations and applicable to all probe configurations. (D.C.W.)

3420 MEASUREMENT OF THE TEMPERATURE OF "JET COLUMN OF ARGON PLASMA" FROM ITS CONTINUOUS EMISSION IN THE FAR INFRARED. François Cabannes, Joseph Chapelle, and Alassane Sy (Centre National de la Recherche Scientifique, Bellevue, France). Compt. Rend., 259: 1714-16(Sept. 7, 1964). (In French)

The continuous absorption and emission spectra of an argon plasma jet were studied in the spectral region from 300 to 3000 cm^{-1}. The plasma temperature was calculated assuming thermodynamic equilibrium and using the Kirchhoff law. The continuous absorption spectrum can be attributed to free electrons — the emission to bremsstrahlung. The theory and experiment are in good agreement. (tr-auth)

3421 PROPAGATION OF ULTRASONIC WAVES IN PLASMAS. P. Venkatarangan (National Aeronautical Lab., Bangalore, India). Current Sci. (India), 33: 551(Sept. 20, 1964).

The interactions of ultrasonic waves with isothermal or non-isothermal plasma are studied, for any value of ionic atomic number. The method yields the ultrasonic-wave propagation characteristics in the plasma, as well as the electronic and ionic temperatures in the plasma. (T.F.H.)

3422 A SOLVABLE PROBLEM IN THE THEORY OF PLASMA TURBULENCE. A. A. Galeev, V. I. Karpman, and R. Z. Sagdeev (Novosibirskii State Univ., USSR). Dokl. Akad. Nauk SSSR, 157: 1088-91(Aug. 11, 1964). (In Russian)

When the turbulent pulsations of a plasma are an assembly of plasma waves, the turbulence can be described by a closed set of integro-differential equations for an average particle distribution in the plasma (the quasilinear kinetic equation), and for the spectral energy densities of the different plasma waves (the kinetic equations for interacting waves). The integral kinetic equations for the spectral

energy density of the waves are non-linear, and it becomes difficult to find an analytical solution to the equations. One of the problems of this type that has been resolved is the problem of the non-linear time evolution of the spectrum of Langmuir electron oscillations in a homogeneous plasma without a magnetic field. It was found that the ions play the principal role in the non-linear relaxation of the electron oscillations. This result might appear to be paradoxical at first glance, but it was found that the effect of the ions must be taken into account in a number of cases. (TTT)

3423 THE ENERGY SPECTRA OF PLASMA INTERACTING WITH A TRANSVERSE MAGNETIC FIELD. I. I. Demidenko, V. G. Padalka, B. G. Safronov, and K. D. Sinel'nikov (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Dokl. Akad. Nauk SSSR, 157: 1335-7(Aug. 21, 1964). (In Russian)

A study of the interaction of a plasma bundle with a transverse magnetic field showed that part of the injected bundle passes through the transverse magnetic field, while part of the bundle is captured by the field and moves longitudinally to the field. The energy distribution of plasma ions was carried out by an electrostatic analyser, and a mass analysis was performed with a mass-spectrometer. No protons with energies >600 ev penetrate a transverse magnetic field of ~ 25 gauss. On increasing the strength of the magnetic field to 150 gauss, hydrogens ions with energies >200 ev cannot penetrate the transverse field. The mass composition of the plasma captured by the magnetic field has a much higher relative content of hydrogen in comparison with the injected plasma. With increasing strength of the transverse magnetic field, the energy spectrum of plasma hydrogen ions passing through the field is shifted to the side of lesser energies, while the energy spectrum of plasma protons moving longitudinally to the magnetic field is shifted to the side of higher energy. Hydrogen ions with energies >600 ev are completely absent at a field strength of 500 gauss in a plasma moving longitudinally to the magnetic field. (TTT)

3424 PLASMA DENSITY MEASUREMENT BY USE OF FM DEMODULATORS. Nobuki Kawashima (Japan Atomic Energy Research Inst., Ibaraki, Japan). Japan J. Appl. Phys., 3: 557-8(Sept. 1964).

Experimental results of a new circuit for plasma density measurements are presented. This method utilizes FM demodulators. The circuit and its characteristics are discussed, and results are given for an argon plasma. (C.E.S.)

3425 OBSERVATION OF THOMSON AND COOPERATIVE SCATTERING OF RUBY LASER LIGHT BY A PLASMA. A. W. DeSilva, D. E. Evans, and M. J. Forrest (United Kingdom Atomic Energy Authority, Abingdon, Berks, Eng.). Nature, 203: 1321-2(Sept. 26, 1964). (CLM-P-57)

An experiment is described by which Thomson and collective scattering of light were detected in the same plasma by changing the direction from which the scattered light was observed. (D.C.W.)

3426 EFFECT OF GAS FLOW ON THE PROPERTIES OF A PLASMA COLUMN. Kenneth W. Gentle, Uno Ingard, and George Bekefi (Massachusetts Inst. of Tech., Cambridge). Nature, 203: 1369-70(Sept. 26, 1964).

The effects of gas flow on the properties of a weakly ionized d-c discharge in Ar were investigated at pressures of 2 to 30 mm Hg with discharge currents of 15 to 200 mamp and gas flow velocities from zero to 1.5×10^4 cm/sec. The main effects are described. (D.C.W.)

3427 COMPARISON OF FOKKER-PLANCK AND BHATNAGAR-GROSS-KROOK EQUATIONS. Mahesh S. Grewall (Aerospace Corp., Los Angeles). Phys. Rev., 136: A1181-6(Nov. 30, 1964).

A Fokker-Planck equation, such as the one used in the theory of Brownian motion, and the Bhatnagar-Gross-Krook equation (Phys. Rev., 94: 511(1954)), which conserves only number density, are compared via their transition probabilities. These two equations have been used in various problems arising in the study of plasmas. It is shown that for time intervals large compared with the average collision time, the two equations give the same results. For the opposite limit of times small compared with the collision time, the disparity between the two equations increases as the initial velocity of the test particle increases; however, the difference between the two transition probabilities is shown to be reduced if the initial velocity distribution is Maxwellian. (auth)

3428 COUPLING OF MAGNETOHYDRODYNAMIC WAVES IN STRATIFIED MEDIA. H. Poeverlein (Air Force Cambridge Research Labs., Bedford, Mass.). Phys. Rev., 136: A1605-13(Dec. 14, 1964).

The theory presented deals with propagation of magnetohydrodynamic waves in a plasma whose propagation characteristics vary along the path of propagation. Plane waves with wave normals in the direction of the gradient of the medium are assumed. Modified Alfvén waves and acoustic waves obey a set of coupled wave equations. Alfvén waves are decoupled by a restricting assumption on the variation of the static magnetic field. The main aim is to demonstrate the generation of fairly intense acoustic waves in propagation of modified Alfvén waves in a steep gradient of the propagation conditions. This effect is investigated at a boundary which is equivalent to a very steep gradient. (auth)

3429 ON THE POSSIBLE SIMPLIFICATION OF EQUATIONS FOR COMPLETELY IONIZED TWO-TEMPERATURE PLASMA. V. V. Gogosov. Prikl. Mat. i Mekhan., 28: 852-61(Sept.-Oct. 1964). (In Russian)

Equations for totally ionized dual-temperature plasma were simplified by writing critical parameter magnitudes without considering anisotropic transfer coefficients or electron and ion viscosity. Mathematical evaluation indicated that at sufficiently high electron temperatures the electron viscosity terms must be considered thus converting from an algebraic relation to a nonlinear differential equation. The terms for a single-temperature plasma were evaluated under the assumption that $U \sim \Omega/\omega_i$ (inertia terms are similar to electromagnetic) and $\pi_e \ll \pi_i$. Simplified mobility and ohm's law equations were developed for a single-temperature plasma at $T_e \sim T_i$. (R.V.J.)

3430 DETERMINATION OF ELECTRON TEMPERATURE OF A THETA-PINCHED HYDROGEN PLASMA BY MEANS OF CARBON LINE RADIATION. Chieh Ho (Allis-Chalmers Mfg. Co., Milwaukee) and Dick Duffey. Trans. Am. Nucl. Soc., 7: 266(Nov. 1964).

3431 THE ROLE OF THE INERTIA-FORCE IN LINEAR Z-PINCHES. W. Hertz, A. Koller, and A. Michel (Siemens-Schuckertwerke AG, Erlangen, Ger.). Z. Naturforsch., 19a: 1089-98(Sept. 1964). (In German)

In a fast linear z-pinch (f = 600 kc/s, W = 800 joules) the Lorentz force is essentially effective on the plasma near the chamber wall. Only during the later phase of the implosion does it prevent the formation of the rarefaction wave, which propagates radially outward from the outer surface of the pressure wave following the shock front. The vanishing of the Lorentz force does not influence further propagation of the cylindrical shock wave if the discharge is crowbarred in the first current-zero before the shock front hits the axis or if the current is damped to a small amount compared with its initial value. No Kruskal-Schwarzschild instabilities were observed. Under these conditions the z pinch may be followed by a Θ pinch before the plasma of the first reaches the chamber walls. There is no screw-shaped superposition of the magnetic fields in this case. Theoretical calculations of the plasma flow were in good qualitative agreement with the experiments. For a 60-ka discharge plasma pressure and temperature were calculated at the time of maximum contraction by numerical integration of the equation of motion. (auth)

3432 THEORY OF THE PLASMA RESONANCE PROBE. H. K. Wimmel (Institut für Plasmaphysik GmbH, Garching, Ger.). Z. Naturforsch., 19a: 1099-1106(Sept. 1964).

The d-c electron current to a resonance probe, as a function of frequency and other pertinent parameters, was computed from a 1-dimensional plasma-sheath model. From linearized macroscopic plasma equations with damping, the longitudinal r-f field that was caused in the two-slab

model by the applied r-f voltage was derived. The dielectric constant in the sheath was taken to be 1; the sheath thickness was estimated from the Langmuir-Child law. In accordance with Mayer, there occurred an r-f resonance at a frequency $\omega'_{res} \leq \omega_s < \omega_p$, where ω_s/ω_p was determined by the probe-sheath-plasma geometry. The d-c electron current to the probe was computed numerically by means of an approximate classification of the (collisionless) electron orbits in the combined d-c and r-f fields. There followed a d-c resonance at $\omega_{res} \leq \omega_s$, but none at the plasma frequency ω_p. For $\omega \ll \omega_{res}$ and $\omega \gg \omega_{res}$ the correct limiting values of the d-c current were reproduced. There was good qualitative agreement with recent experimental results by Peter, Müller, and Rabben, but disagreement with a theory by Ichikawa and Ikegami. Arguments are presented that speak against the validity of that theory. (auth)

3433 ON THE INFLUENCE OF ION SHEATHS UPON THE RESONANCE BEHAVIOR OF A R-F PLASMA PROBE. G. von Gierke (Institut für Plasmaphysik GmbH, Garching, Ger.), G. Mueller, G. Peter, and H. H. Rabben. Z. Naturforsch., 19a: 1107-11(Sept. 1964).

The applicability of the r-f resonance-probe method to measurement of the electron density in a plasma was investigated in a thermal plasma of low density. Experiments showed that in contrast with previous investigations published, the resonance frequency determined by the r-f probe did not agree with the plasma frequency but was found always to be lower than this. The difference between resonance frequency and plasma frequency was caused by the ion sheath in front of the probe; the thickness of the sheath determined the amount of the frequency shift. Therefore, the r-f resonance-probe determination of the electron density was valid only if the geometrical dimensions of the probe environment were taken into account. By the r-f probe, information on the plasma ion sheath, namely in front of the probe, could be obtained. (auth)

3434 MAGNETIC FIELD MEASUREMENTS USING THE ZEEMAN EFFECT. Klaus Huebner (Institut für Plasmaphysik, Garching, Ger.). Z. Naturforsch., 19a: 1111-20(Sept. 1964). (In German)

A method for the measurement of time-variable magnetic fields from the Zeeman effect of time-variable line emission is described. This method is independent of the special line profile and of time variations in intensity, line profile, and line shift. The sensitivity of the method and the accuracy of the measurement are discussed. Test measurements were made in a nitrogen discharge with an external homogeneous magnetic field having 130 kc/sec frequency. The measurement of inhomogeneous fields from spatial inhomogeneous line emission gave a mean value of the field, which depends on the spatial distribution of the line emission. Nevertheless, measurements made on a little fast Θ-pinch with a N II line, which was emitted from the hot plasma, were reproducible. (auth)

3435 PLASMA ACCELERATION IN EXPANDING SUPERSONIC FLOW. Th. Peters (DVL-Institut für Plasmadynamik, Stuttgart). Z. Naturforsch., 19a: 1129-30(Sept. 1964). (In German)

Experiments were carried out to determine if a high-current arc is capable of existence and stable in an expanding supersonic flow. The apparatus is described and conditions discussed. (M.C.G.)

3436 EXPERIMENTS ON ATTAINING HIGHER ARC TEMPERATURE BY REDUCTION OF THERMAL CONDUCTIVITY IN A MAGNETIC FIELD. C. Mahn, H. Ringler, R. Wienecke, S. Witkowski, and G. Zankl (Institut für Plasmaphysik, Garching, Ger.). Z. Naturforsch., 19a: 1202-7 (Oct. 1964). (In German)

Currently, in different types of high-pressure arc the maximum temperature is limited by radial heat conduction. Heat conduction can be reduced by a magnetic field parallel to the axis of the arc. An experiment is described in which arc temperatures in the region of 10^{5}°K were reached. Typical conditions for the discharge in hydrogen are: current = 2000 amps, magnetic field = 10 kGauss, power input = 4 kw per cm arc length, and pressure inside the arc = 0.1 atmosphere. A similar experiment was made with helium. (auth)

3437 CYBERNETIC STABILIZATION OF INSTABILITIES IN A PLASMA. A. I. Morozov and L. S. Solov'ev. Zh. Tekhn. Fiz., 34: 1566-75(Sept. 1964). (In Russian)

Theoretical and experimental data indicate effective plasma stabilization by increasing magnetic pressure away from the surface. A series of systems using increasing periphery constants and variable fields was investigated. A cybernetic approach to stable containment, considering plasma equilibrium in a trap, was accomplished by a special system which exerts local forces near plasma cusps. The magnitude of the confining field was proportioned to plasma density, therefore, in low density systems it was quite small. A similar system was previously suggested by L. A. Artsimoviche et al. (Doklady Akad. Nauk, 146: 1305(1962)) for pinch position control in Tokomak. An attempt was made to apply the method in stabilizing channel plasma in a trap with magnetic mirrors or an undulated torus. Stabilization of Taylor instability in a plasma supported by a field along the Z axis, stabilization of plasma cylinder oscillations, stabilization of a rotating pinch, and helical perturbations in a plasma cylinder with a longitudinal current were considered. (R.V.J.)

3438 ON THE PLASMA DIFFUSION ANOMALY IN MAGNETOHYDRODYNAMICS. I. A. Daneliya and N. L. Tsintsadze. Zh. Tekhn. Fiz., 34: 1576-9(Sept. 1964). (In Russian)

Interactions between magnetosonic waves propagating across magnetic fields were studied using the method of stationary waves. An expression was found for relating density to the magnetic field. It is shown that anomalous diffusion (or a diffusion velocity inversely proportional to the magnetic field) takes place at Alfvén velocities larger than thermal. (tr-auth)

3439 ON THE NONLINEAR OSCILLATIONS IN A PLASMA OF TWO COMPONENTS. N. P. Giorgadze (Inst. of Physics, Tbilisi, Georgian SSR). Zh. Tekhn. Fiz., 34: 1580-7(Sept. 1964). (In Russian)

Nonlinear oscillations of two-component plasma were studied considering the temperature effect and ion motion. The linear approximation and field emission and longitudinal oscillations in second approximation are discussed, as well as the influence of nonlinear effects on plasma density. (R.V.J.)

3440 ON THE THEORY OF THE STATIONARY STATE OF A HIGH-TEMPERATURE PLASMA. E. F. Tkalich and V. S. Tkalich. Zh. Tekhn. Fiz., 34: 1588-92(Sept. 1964). (In Russian)

Stationary states of high temperature plasma were studied previously using either continuous kinetic equations or solutions of the first order. First order solutions were used for studying current separation and the structure of transitional layers. The solution of the kinetic equations, the macroscopic magnitudes, and the ratios between physical magnitudes are analyzed. It is shown that the stationary state takes place at a sufficiently low temperature in compressed plasma, the density of the current carrying component diminishes as the potential and velocity are increased, and the equation-of-state contains dimensionless parameters which describe the properties of separate plasma components at infinity. As in ordinary hydrodynamics the temperature is a smoothly increasing function of density. (R.V.J.)

3441 DISTRIBUTION OF A WAVE IN A PLASMA ALONG A MAGNETIC FIELD. A. D. Pataraya. Zh. Tekhn. Fiz., 34: 1593-6(Sept. 1964). (In Russian)

Studies were made of wave propagation in a hot plasma. The criterion for the existence of one-dimensional, steady, finite amplitude waves was found considering the thermal motion of particles. Plasma quasi-linearity was assumed, and particle collisions were not considered. It is shown that only fast magnetosonic waves can exist, and that electrons and ions take a spiral motion around the external magnetic field. (tr-auth)

3442 ON THE THEORY OF THE HYDROTHERMOMAGNETIC WAVES IN A WEAKLY INHOMOGENEOUS PLASMA. L. E. Gurevich and B. L. Gelmont (Ioffe Inst.

of Physics and Tech., Leningrad). Zh. Tekhn. Fiz., 34: 1597-1604(Sept. 1964). (In Russian)

Studies of thermomagnetic waves showed that transitions from strongly ionized to weakly ionized plasma create wave reflections. Wave polarization and velocities were studied in a plasma with an external magnetic field and a temperature gradient. Stable waves have linear polarization, unstable waves have elliptic or spherical polarization. Drift approximations were used to indicate wave instability in strong fields. (tr-auth)

3443 INTERACTION OF HIGH-DENSITY PLASMOIDS WITH A SPACE-PERIODICAL MAGNETIC FIELD. A. A. Kalmykov and V. I. Tereshin (Khar'kov Inst. of Physics and Tech.). Zh. Tekhn. Fiz., 34: 1605-12(Sept. 1964). (In Russian)

Investigations of interactions between plasmoids with particle densities of ~10^{20} to 10^{21} M^{-3} and periodical magnetic fields indicate the great importance of collision processes at such high densities. The studies show that resonance interactions of plasmoids with the field transform a considerable part of the longitudinal particle energy into Larmor rotation energy. The resonance curves for relative particle number variations in plasmoids passing a magnetic barrier, oscillograms of microwave cut-off near a magnetic mirror, and the relative stretching of the cut-off for 8 and 4 mm waves as a function of field are in good agreement with curves developed for low density plasmoids by the independent particle model. (R.V.J.)

3444 HIGH-VELOCITY NON-ISOTHERMAL PLASMA FLOWS. M. F. Shirokov and E. P. Vaulin (Academy of Sciences, USSR). p.497-510 of "High Temperature Technology." Washington, D. C., Butterworths, 1964.

The equations of plasma thermo- and gas-dynamics are formulated from a phenomenological and molecular kinetics viewpoint, taking into account nonisothermal and multi-component characteristics of the plasma. The stationary motion of a three-component plasma is considered in some detail. (D.C.W.)

3445 PHYSIQUE DES PLASMAS. TOME 1. (Physics of Plasmas. Volume I). J. L. Delcroix. Monographies Dunod. Paris, Dunod, 1963. 300p.

Theory for the behavior and properties (microscopic and macroscopic) of plasmas is reviewed with emphasis on methods of study, the relations between the microscopic and macroscopic descriptions of plasmas, and plasma containment. (D.C.W.)

3446 METHOD FOR THE INTRODUCTION OF A CONDENSED NUCLEAR FUEL MATERIAL INTO A GENERATING DEVICE FOR HIGH-TEMPERATURE PLASMA. Erwin Becker and Wolfgang Henkes (to Gesellschaft fur Kernforschung mbH). German Patent 1,178,152. Sept. 17, 1964. Filed May 12, 1962.

Dispersed, condensed nuclear fuel material was injected into a device for generation of a high-temperature plasma. The method consists of charging the condensed fuel electrically and accelerating it electrically to high kinetic energies, e.g. 100 ev/atom. The charging of the nuclear fuel is carried out in such a way that one electronic charge adheres to at least 10 condensed molecules or atoms. (Gmelin Inst.)

3447 PLASMA ACCELERATOR SYSTEM. Per Gloersen, Bernard Gorowitz, and Kenneth G. Moses (to General Electric Co.). U. S. Patent 3,151,259. Sept. 29, 1964. Filed Aug. 18, 1959.

A plasma accelerator for space propulsion is described which combines magnetohydrodynamic pressure and ohmic heating. A conical electrode is arranged inside a cylindrical one to provide a gap diverging toward the nozzle, with a radial electric field and an axial magnetic field. Pulses of low-density gas are admitted triggering the accelerator circuits and causing a flow of plasma. The magnetic field diverges throughout the plasma area giving greater efficiency. Ohmic heating contributes to the propulsive power through pressure gradients from the time-varying magnetic field and the radial discharge current. (T.R.H.)

3448 APPARATUS FOR HEATING IONS IN A PLASMA. Milton M. Hill and Donald F. Martin (to U. S. Atomic Energy Commission). U. S. Patent 3,156,622. Nov. 10, 1964.

A process for producing an energetic plasma is described, involving sequential establishment of a radially inhomogeneous axially symmetric magnetic containment field in an evacuated space, establishment of a ring of plasma coaxially of the field centrally around the containment field, intensification of the magnetic field to spiral the plasma particles radially inward, provision of a radially homogeneous magnetic containment field, and intensification of the magnetic field to produce a highly energetic plasma. (AEC)

3449 PLASMA SWITCHING PINCH TUBE. William R. Baker (to U. S. Atomic Energy Commission). U. S. Patent 3,156,623. Nov. 10, 1964.

An MHD apparatus for ionizing a gas to form a pure ion-electron plasma is described, in which the plasma is heated and contained using the pinch effect. High plasma purity is obtained by ejecting plasma which has been polluted by insulator impurities. A high voltage between a pair of coaxial cylinders ionizes a gas between the cylinders, the gas space being bounded at one end by an annular insulator. The resulting current through the plasma causes the plasma to be accelerated longitudinally and ejected from between the cylinders, leaving pure plasma near the end of the inner cylinder. A pinch discharge then occurs between the end of the inner cylinder and an additional adjacent electrode electrically connected to the outer cylinder. (AEC)

Shielding

Refer also to abstracts 3221 and 3771.

3450 (AE-157) MEASUREMENTS OF NEUTRON AND GAMMA ATTENUATION IN MASSIVE LAMINATED SHIELDS OF CONCRETE AND A STUDY OF THE ACCURACY OF SOME METHODS OF CALCULATION. E. Aalto and R. Nilsson (Aktiebolaget Atomenergi, Stockholm). 1964. 114p. Dep.(mn).

Extensive neutron and gamma attenuation measurements were performed in magnetite and ordinary concrete up to a depth of 2 meters in order to study the accuracy attainable by some shield calculation methods. The effect of thin, heavy layers (Pb) was also studied. Experimental facilities and instrumentation, especially the foil detection methods used for thermal and epithermal neutrons, are described in some detail. Great weight is laid upon a thorough error analysis. The fluxes measured are compared to those calculated by an earlier version of the British 18-group removal method (RASH B_3), by an improved removal method (NRN), and by numerical integration of the Boltzmann equation (NIOBE). The results show that shielding calculations with the newer methods give fluxes that are generally within a factor of 2 to 3 from the true values. A greater accuracy seems to be difficult to obtain in practice in spite of possible improvements in the mathematical solution of the transport problem. The greatest errors originate in the translation between the true and calculation geometries in the uncertainty of material properties in the case of concrete, and in approximations and inaccuracies of radiation sources. 62 references. (auth)

3451 (AEEW-R-377) THE CALCULATION OF FAST NEUTRON SPECTRA FOR PRESSURE VESSEL DAMAGE STUDIES. A. F. Avery and J. Butler (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). May 1964. 29p. Dep.; $0.80(BIS); 4s. (HMSO).

Radiation damage in reactor environments is principally caused by fast neutrons, and a knowledge of the neutron spectrum between about 0.01 and 9 Mev is an essential requirement for predicting damage rates in steel pressure vessels. At the present time, numerical solutions to the transport equation for laminated shields in one dimension can be obtained by iterative methods, and the neutron pene-

tration problem in more complex geometries can in principle be tackled by Monte Carlo methods in which special sampling techniques are employed to reduce the variance in regions remote from the source. For design calculations, the computing time requirements of both iterative and Monte Carlo methods are prohibitively large and their accuracy at deep penetration is limited by the fundamental cross section data. These disadvantages are to some extent overcome in the multigroup removal source method which has proved to be a valuable tool for secondary gamma source predictions in shields. An attempt has accordingly been made to extend the scope of this technique in order to calculate the fast neutron spectrum in laminated shields for the study of pressure vessel damage. The new model has been applied to graphite, water, and D_2O-moderated systems; it compares favorably with the more rigorous techniques and affords a simple and relatively accurate design method for predicting the neutron spectrum incident on a reactor vessel in regions which are not perturbed by ducts and voids. (auth)

3452 (JAERI-4029) STATUS REPORT OF SHIELDING INVESTIGATION IN JAPAN. (Japan Atomic Energy Research Inst., Tokyo). Apr. 1964. 31p. (CONF-457-2). Dep.(mn).

From International Atomic Energy Agency Panel Meeting, Vienna, Mar. 1964.

Shielding studies, both experimental and theoretical, which have been done in Japan to the beginning of 1964, are described. Some computer codes developed in Japan are also described as well as a brief outline of the JRR-4. (auth)

3453 (NAA-SR-Memo-9327(Add.)) MORTIMER—A MODIFICATION OF THE RATRAP CODE WHICH INCLUDES THE TWO COMPONENT METHOD OF SHIELD ANALYSIS; ADDENDUM. W. B. Green (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Aug. 12, 1964. Contract AT-11-1-GEN-8. 12p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Changes made to the MORTIMER code are documented, and listings of subroutines ROOTS, DIFUSE, and GRAPHS are included. For original MORTIMER, see NSA, 18: 13176. (auth)

3454 (TID-21294) NEUTRON CROSS SECTIONS FOR NEUTRON ATTENUATION PROBLEMS PROPOSED BY THE ANS SHIELDING DIVISION. Herbert Goldstein, comp. (Columbia Univ., New York). Mar. 30, 1963. Contract AT(30-1)-2999. 90p. Dep.(mn); $3.00(cy), 2(mn) OTS.

Proposed standard cross sections for H, Li, Be, C, O, Si, Fe, and ^{238}U are given. Included are total, elastic and inelastic scattering, and absorption. (R.E.U.)

3455 (USNRDL-TR-730) PENETRATION OF PLANE NORMAL GAMMA RAYS THROUGH SLABS OF ALUMINUM AND STEEL. III. PROCESSED NUMERICAL DATA. J. T. Serduke and C. V. Smith (Naval Radiological Defense Lab., San Francisco). Feb. 17, 1964. 169p. (AD-600392).

Tabular and graphical data from experimental measurements of scattered gamma radiation from slabs of aluminum and steel are presented. The original investigations are reported in USNRDL-TR-272 (NSA, 13: 2282) and USNRDL-TR-475 (NSA, 15: 6635). Monoenergetic gamma rays from ^{137}Cs and ^{60}Co sources with plane-normal incidence were used. Detection angles were 5, 10, 20, 30, 45, and 60° with effective thicknesses of 1, 2, 3, 4, and 5 "mean-free-paths" of slab material. Spectra were found at larger angles by an extrapolation method, which is described. Calculations of dose and buildup are included. (R.E.U.)

3456 (ORNL-tr-349) ON THE BUILD-UP FACTORS OF CONCRETE: COEFFICIENTS OF THE POLYNOMIAL REPRESENTATION. S. Buscaglione and R. Manzini (Italy. Comitato Nazionale per l'Energia Nucleare, Bologna). Translated for Oak Ridge National Lab., Tenn., from report CEC-94. June 1964. 11p. Dep.(mn); $1.60(fs), $0.80(mf) JCL.

Bivariant polynomial coefficients of the gamma dose for a point isotropic source were derived for ordinary concrete, magnetite concrete, ferrophosphorus concrete, and barite concrete. (auth)

3457 PLASMA RADIATION SHIELDING. Richard H. Levy and G. Sargent Janes (Avco-Everett Research Lab., Everett, Mass.). AIAA (Am. Inst. Aeron. Astronaut.) J., 2: 1835-8(Oct. 1964).

A shielding system for space vehicles is proposed in which protons are repelled by a positive electrostatic potential and electrons are constrained to drift azimuthally around the vehicle by a magnetic field, creating an electron plasma. (D.C.W.)

3458 PRACTICAL CALCULATION OF THE ATTENUATION OF NEUTRON INTENSITY IN CONCRETE SHIELDING. Ferenc Seboek. Energia Atomtech., 17: 385-90(Aug. 1964). (In Hungarian)

A method for calculating the attenuation of a neutron flux in a concrete shield is described, requiring only the use of a slide rule and a table of the e^{-x} function. (D.C.W.)

3459 DETERMINATION OF THE FAST-NEUTRON FLUX PATTERN FOR A SMALL 14-Mev NEUTRON GENERATOR. B. T. Kenna and F. J. Conrad (Sandia Lab., Albuquerque, N. Mex.). Trans. Am. Nucl. Soc., 7: 319-20 (Nov. 1964).

3460 ELECTRON SHIELDING FOR SPACE VEHICLES. B. W. Mar (Boeing Co., Seattle). Trans. Am. Nucl. Soc., 7: 322-3(Nov. 1964).

3461 NTC: A TRANSPORT CODE FOR PROTONS AND NEUTRONS OF ENERGY UP TO 400 Mev. W. E. Kinney (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 324(Nov. 1964).

3462 NEUTRON HEAT LOAD IN CONCRETE REACTOR SHIELDS. D. R. Thomas (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 353-4(Nov. 1964).

3463 USE OF THE TRANSPORT CODE, DTK, FOR SHIELD DESIGN AND ANALYSIS. S. T. Friedman, J. L. Rathbun, and R. M. Kaufman (General Motors Corp., Indianapolis). Trans. Am. Nucl. Soc., 7: 354-5(Nov. 1964).

3464 THE DOSE RESULTING FROM 1.25-Mev PLANE SOURCE BEHIND VARIOUS ARRANGEMENTS OF DISK AND RECTANGULAR BARRIERS. Dominic J. Raso and Stanley Woolf (Technical Operations, Inc., Burlington, Mass.). Trans. Am. Nucl. Soc., 7: 356-7 (Nov. 1964).

3465 THE GAMMA-RAY ATTENUATION INTRODUCED BY SLABS PERPENDICULAR TO A SEMI-INFINITE PLANE SOURCE OF CONTAMINATION. Charles E. McDonnell and John F. Batter (Conesco, Cambridge, Mass.). Trans. Am. Nucl. Soc., 7: 359(Nov. 1964).

3466 EXPERIMENTAL EVALUATION OF THE WALL-SCATTERING FUNCTION $G_1(\omega)$. James L. Jones (Technical Operations, Inc., Burlington, Mass.). Trans. Am. Nucl. Soc., 7: 359-60(Nov. 1964).

3467 RELATIVE IMPORTANCE OF VARIOUS REGIONS IN A REFLECTING INTERFACE. A. B. Chilton (Univ. of Illinois, Urbana). Trans. Am. Nucl. Soc., 7: 360-1(Nov. 1964).

3468 DESIGN METHOD FOR HOT CELL FACILITIES BY A CO-ORDINATE SYSTEM. Masaaki Sukuta (Taisei Construction Co., Ltd., Tokyo). Trans. Am. Nucl. Soc., 7: 361-2(Nov. 1964).

3469 DOSE CONTRIBUTIONS FROM VARIOUS INTERIOR SURFACES WITHIN A CONCRETE DUCT. James M. Chapman (Naval Civil Engineering Lab., Port Hueneme, Calif.). Trans. Am. Nucl. Soc., 7: 362-3(Nov. 1964).

3470 COBALT-60 BACKSCATTERING BY A CONCRETE INTERFACE. A. B. Chilton (Univ. of Illinois, Urbana) and W. H. Henry. Trans. Am. Nucl. Soc., 7: 363-4(Nov. 1964).

3471 A SEMIEMPIRICAL FORMULA FOR DIFFERENTIAL DOSE ALBEDO FOR NEUTRONS ON CONCRETE. Yo Taik Song and C. M. Huddleston (Naval Civil Engineer-

ing Lab., Port Hueneme, Calif.). Trans. Am. Nucl. Soc., 7: 364-5(Nov. 1964).

3472 CALCULATION AND MEASUREMENT OF THE FAST-NEUTRON DIFFERENTIAL DOSE ALBEDO FOR CONCRETE. R. E. Maerker and F. J. Muckenthaler (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 365(Nov. 1964).

3473 MONTE CARLO CALCULATIONS AND EXPERIMENTAL DATA FOR RADIATION STREAMING THROUGH BENT DUCTS. J. D. Marshall (General Dynamics/Fort Worth, Tex.). Trans. Am. Nucl. Soc., 7: 365-6(Nov. 1964).

3474 SIMPLIFIED METHODS FOR CALCULATING THE PENETRATION OF NEUTRON AND GAMMA RADIATION INTO UNDERGROUND CONCRETE STRUCTURES. D. G. Collins, R. L. French, K. W. Tompkins, and M. B. Wells (Radiation Research Associates, Inc., Fort Worth, Tex.). Trans. Am. Nucl. Soc., 7: 366-7(Nov. 1964).

3475 NUCLEAR RADIATION SHIELDS FOR ELECTRONIC COMPONENTS. Eugene V. Kleber and Alfred R. Bobrowsky (to Nuclear Corp. of America). U. S. Patent 3,148,280. Sept. 8, 1964. Filed Aug. 28, 1959.

A shielding material to protect electronic equipment from nuclear radiation is described. The material consists of rare-earth oxides mixed with organic potting materials; the materials mentioned include Gd_2O_3, Dy_2O_3, Eu_2O_3, and Pb compounds. (T.R.H.)

REACTOR TECHNOLOGY

General

Refer also to abstracts 2713 and 2907.

3476 (IA-980) NUCLEAR CROSS SECTIONS FOR FAST REACTORS. S. Yiftah and M. Sieger (Israel. Atomic Energy Commission. Soreq Research Establishment, Rehovoth). July 1964. 111p. Dep.(mn).

See also A/CONF.28/P/510.

Some revisions to the previously published 16-group YOM cross section set are presented. An extension is made from 16 to 20 groups by additions in the 2 to 14 Mev range. Both sets take account of new information on neutron angular distributions, modified inelastic scattering matrices, modified capture cross sections for fissile nuclides, modified $\bar{\nu}$, and modifications for errors and omissions. The materials studied are the same as in YOM, namely: ^{242}Pu, ^{241}Pu, ^{240}Pu, ^{239}Pu, ^{238}U, ^{235}U, ^{233}U, ^{232}Th, Bi, Pb, Ta, Mo, Nb, Zr, Ni, Fe, Cr, V, Ti, K, Al, Na, O, C, and B. (R.E.U.)

3477 (WCAP-3269-8) HYDRAULIC TESTS OF THE SAN ONOFRE REACTOR MODEL. G. Hetsroni (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). June 1964. Contract AT(30-1)-3269. 127p. Dep.(mn); $4.00(cy), 3(mn) OTS.

Experimental studies were conducted on a one-seventh scale model of the San Onofre Reactor. Seven lower plenum configurations were tested and compared with regard to the pressure drop of various components and with regard to the flow distribution at the inlet to the core. Based on these studies and the change to Rod Cluster Control which requires no control rod followers, the vessel length of the San Onofre plant was reduced by seventy inches and other changes were made in the internal components. In addition, the inlet flow distribution subfactor in the engineering hot channel factor was reduced and the estimates for the pressure drop in the vessel were revised. (auth)

3478 THE FRENCH ATOMIC PROGRAM. Pierre Pelletier (Commissariat á l'Énergie Atomique, Orsay, France). Bull. Inform. A.T.E.N. (Assoc. Tech. Energie Nucl.), No. 48, 43-8(July-Aug. 1964). (In French)

A brief survey is given of the complex of the French atomic energy program, with emphasis on the reactor development studies. Military applications, development and diversification of radioisotope use, and space studies are also considered. (J.S.R.)

3479 THE EFFICIENCY OF ARBITRARY CONFIGURATIONS OF RODS FULLY INSERTED INTO AN ANNULAR ZONE REACTOR. H. Kiesewetter (VEB Atomkraftwerk, Berlin). Kernenergie, 7: 654-64(Sept. 1964). (In German)

A method is given for calculating the efficiency of arbitrary configurations of rods fully inserted into an annular zone reactor. In addition to this the method permits the determination of both the fast and thermal flux at any point of the reactor core and the radial non-uniformity factor of the thermal flux. It is possible to deal with any type of rod-shaped heterogeneities such as absorbing rods, rods with highly enriched fuel, non-absorbing lower parts of absorbing rods, and, additionally, water and air holes. The order of the critical system of equations is equal to the number of rings of rods. (auth)

3480 PHYSICS. Power Reactor Technol., 7: 329-34(1964).

The efficacy of the Doppler effect as a shutdown agency in power excursions is discussed, and recent work on Doppler evaluations are reviewed and some thermal calculations given. The programming of control rod withdrawal is also reviewed. Nuclear data for Zr, the age of fission neutrons to 1.46 ev in water, and neutron thermalization are discussed briefly. (D.L.C.)

3481 AN EXPERIMENTAL INVESTIGATION INTO THE THRESHOLD OF DEPARTURE FROM NUCLEATE BOILING (DNB) IN A D_2O-MODERATED REACTOR. J. A. Norberg and R. L. Johnson (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 7: 504-5(Nov. 1964).

3482 FURTHER DEVELOPMENTS IN DYNAMIC ANALYSIS OF COOLANT CIRCULATION IN BOILING-WATER NUCLEAR REACTORS. G. K. Sanathanan (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 509-10(Nov. 1964).

3483 A SPACE-DEPENDENT DYNAMIC ANALYSIS OF BOILING WATER REACTOR SYSTEMS. Amir N. Nahavandi and Richard F. Von Hollen (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 510-11 (Nov. 1964).

3484 EURATOM'S R & D PROGRAM. Jules Gueron (European Atomic Energy Community, Brussels). Trans. Am. Nucl. Soc., 7: 513(Nov. 1964).

3485 SPECULATIONS ON FUTURE RAMIFICATIONS OF NUCLEAR ENERGY. B. I. Spinrad (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 527(Nov. 1964).

3486 DAS STRAHLUNGSFELD DES REAKTORS. THIEMIG-TASCHENBUCHER–BAND 22. (The Radiation Field of Reactors. Thiemig Pocketbook –Volume 22). Gerfried Hehn. Munich, Verlag Karl Thiemig KG, 1964. 117p.

The methods for the calculation of the neutron and gamma radiation fields of a reactor were considered. The usual calculation methods were investigated, collected, and supplemented by suitable methods, and used for the optimization of reactor shielding. As an example, a power reactor of the pressurized water type with 450 Mw thermal output was used. The fundamentals of shielding were first considered. The actual shielding calculation was divided into neutron economy, gamma economy, and heat development of neutron and gamma beams. The methods used for each were developed and the calculations were carried out. (J.S.R.)

Auxiliaries and Components

3487 (NYO-3416-1) SPECIFICATION GUIDELINES FOR NUCLEAR PRESSURE VESSELS. W. E. Cooper and D. F. Landers (Lessells and Associates, Inc., Waltham, Mass.). Oct. 1964. Contract AT(30-1)-3416. 86p. Dep.; $3.00 (cy), 3(mn) OTS.

Section III of the ASME Boiler and Pressure Vessel Code, Rules for the Construction of Nuclear Vessels, requires that the owner prepare a specific type of Design Specification for each vessel in a nuclear power plant. The purpose of this report is to provide specific guidance in properly specifying the functions, operating conditions, and design requirements for such vessels. Emphasis is placed upon the specific Code paragraphs which require action by the owner. The paragraphs which are pertinent to each of the three Classes of vessel defined by the Code are discussed in separate chapters. Another chapter contains summary tables and reference paragraph numbers. An illustration of the information which must be included in order to define the loadings is contained in an appendix. The problem of assigning a vessel to the proper Class is discussed and illustrated by an appendix. The general applicability of Section III and the need for supplementary requirements and information to supplement the "minimum" requirements contained within the Code are contained in a chapter on general technical considerations. (auth)

3488 SUPERFICIAL BOILING HEAT EXCHANGE IN COOLING REACTORS. Istvan Szentgyoergyi. Energia Atomtech., 17: 90-102(Feb. 1964). (In Hungarian)

3489 AUTOMATIC START-UP OF A RESEARCH REACTOR. I. THE STABILITY ANALYSIS. Takeo Fujisawa and Kenji Sumita (Japan Atomic Energy Research Inst., Tokyo). J. Nucl. Sci. Technol. (Tokyo), 1: 264-75 (Oct. 1964).

Description is given of the control quality (various characteristics and performances of a control system in transient and steady states) of an automatic start-up system which must be clarified before design can be undertaken for a practical system to automate the start-up of a reactor (in this case JRR-1). The results obtained can be extended to the design of automatic start-up systems for other research reactors, insofar as they can incorporate a similar system based on period and power control. First, period and power transfer functions are introduced to examine the control quality of a simplified model of automatic start-up. Next, the transfer function of an adder circuit in the feedback network of the model is derived, including a time-varying gain factor. Using these transfer functions, gain-phase curves of the loop of the model were calculated. Transient performances expected from the curves were confirmed on an analog computer. In addition, two period setting methods were compared for their effects on the control quality of the period control system. (auth)

3490 DESIGN PRACTICE. Power Reactor Technol., 7: 376-84(1964).

The development of flexible control rods for moving in bowed channels in the Experimental Gas Cooled Reactor is described. A brief description is given of the timing system for measuring the free-fall and the snubbing components of the drop time of the safety rods in the Sodium Reactor Experiment. The development of dome seals, helium seals, and surge suppressors for the Plutonium Recycle Test Reactor is described. The Pathfinder recirculation piping and the Lithium-Cooled Reactor Experiment auxiliary systems are considered briefly. (D.L.C.)

3491 AN ULTRA HIGH SPEED REACTOR-IRRADIATION-TRANSPORT SYSTEM FOR ACTIVATION ANALYSIS. Ronald W. Shideler and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc., 7: 329-30(Nov. 1964).

3492 MATERIALS AND STRESS-ANALYSIS PROBLEMS OF PRESTRESSED CONCRETE REACTOR PRESSURE VESSELS. Thomas Jaeger (Techneische Universität, Berlin). Trans. Am. Nucl. Soc., 7: 528-9(Nov. 1964).

3493 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Alan Alfred Cooper (to Societe Anglo-Belge Vulcain S.A.). British Patent 970,496. Sept. 23, 1964. Filed Feb. 1, 1962.

A spectral-shift reactor control system is described. Chambers are arranged for injection and removal of coolant for water-cooled reactors. The D_2O/H_2O ratio can be changed thereby, altering the moderating properties of the coolant. (T.R.H.)

3494 IMPROVEMENTS IN AND RELATING TO PRESSURISED WATER NUCLEAR REACTORS. Arthur Charles Lawrence (to Foster Wheeler Ltd.). British Patent 970,589. Sept. 23, 1964. Filed Aug. 31, 1961.

An improved arrangement for installing electric heaters in PWR pressurizer vessels is described. The accumulation of deposits around the tube pocket is prevented. (T.R.H.)

3495 METHOD OF REGULATING THE OPERATION OF HOMOGENEOUS NUCLEAR REACTORS. Olle Lindstroem (to Allmanna Svenska Elektriska Aktieboiaget). U. S. Patent 3,151,031. Sept. 29, 1964. Priority date Dec. 22, 1959, Sweden.

A homogeneous reactor control and safety system is described. Tanks are connected to the reactor vessel both below liquid level and by the gas-filled spaces above the liquids. Control is effected by adjusting gas pressure. The reactor vessel has two zones; the condensate is returned to the outer zone, thus concentrating fuel in the inner zone. (T.R.H.)

3496 REACTOR CONTROL DEVICE CONTAINING POISON AND FUEL. Robert W. Deutsch and Frank Bevilacqua (to General Nuclear Engineering Corp.). U. S. Patent 3,151,032. Sept. 29, 1964. Filed Dec. 2, 1960.

A reactor poison control rod design is described. The poison element is arranged with fuel material on long rods that pivot. These rods are arranged in a circle so that as the rods turn either the poison material or the fuel will be on the outside of the circle. The rods are semicircular in cross section. (T.R.H.)

3497 LOADING-UNLOADING DEVICE FOR NUCLEAR REACTOR. Lucien Coffin and Camille Le Feuvre (to l'Electricite de France). U. S. Patent 3,151,033. Sept. 29, 1964. Priority date Nov. 15, 1961, France.

A "charging arm" type reactor fuel handling device is described. The arm rotates and pivots to accommodate all fuel channels. (T.R.H.)

3498 GRAB DEVICES. John Ormerod Pounder and Eric Watson (to United Kingdom Atomic Energy Authority). U. S. Patent 3,152,830. Oct. 13, 1964. Priority date Jan. 5, 1961, Great Britain.

A remotely operable grab device was developed for fuel element handling facilities by which the fuel elements provided with fittings appropriate to grasping can be handled. The device is composed of sets of grasping fingers with the fingers of each set disposed symmetrically about the longitudinal axis of the device in planes through the axis, a movable actuating member having an operative range of travel, and coupling means. (M.C.G.)

3499 CONTROL DEVICE FOR CONTROL AND SAFETY RODS FOR NUCLEAR REACTORS. Marc Alfred. U. S. Patent 3,152,960. Oct. 13, 1964. Filed Jan. 13, 1961.

Drawings are presented of a control device for control and safety rods for pressurized-water reactors. The device compresses a longitudinally movable hollow screw in engagement with a nut integral with the rotor of an electric motor and carries, by means of a spring and pin expulsion system, the rod to be controlled and a pin sliding in the hollow screw. This pin is connected for rotation with the rotor of a second motor. The shaft is held by a spring in an angular position corresponding to the inoperative state of the expulsion system and is capable of being placed in a position corresponding to actuation of the system by rotation of the rotor of the second motor. The two motors are disposed one above the other in a hermetically sealed housing attached to the tank of the reactor and enclosing a system of current contacts, a system indicative of the position of the rod, and a thermal barrier. (M.C.G.)

3500 NUCLEAR REACTOR FUELING MACHINE. Frederick S. Hummel (to Atomic Energy of Canada Ltd.). U. S. Patent 3,157,579. Nov. 17, 1964. Filed Mar. 5, 1962.

A ram mechanism for a reactor loading machine is described. This ram can load and unload fuel channels and also release channel plugs and withdraw them and return them. (T.R.H.)

3501 NUCLEAR REACTOR MODERATOR STRUCTURES. René Babule, Georges Lemesle, Roger Martin, and Pierre Rougé (to Commissariat à l'Énergie Atomique). U. S. Patent 3,157,582. Nov. 17, 1964. Priority date Oct. 18, 1958, France.

A reactor moderator structure of improved rigidity and mechanical stability is offered. Hexagonal graphite bars with slots for keys or with integral keys are arranged vertically in a tank. (T.R.H.)

3502 NUCLEAR REACTOR (FUEL ASSEMBLY SUPPORT SYSTEM FOR NUCLEAR REACTOR). J. Sherman, J. E. Sharbaugh, W. Fauth, N. J. Palladino, and P. G. DeHuff (to U. S. Atomic Energy Commission). U. S. Patent 3,158,543. Nov. 24, 1964.

A seed-and-blanket, pressurized-water reactor is described, which has tubular control rod shrouds above the core. Module frames are attached to the shrouds and bear on the seed and blanket assemblies to retain their vertical

movement. A module frame also covers the central fuel element assemblies through which no control rods pass and a central support extends from the module frame to the top of the pressure vessel preventing vertical movement of the central assemblies. (AEC)

Criticality Studies

Refer also to abstract 3719.

3503 (AEEW-M-441) ANALYSIS OF THE RESULTS OF REACTIVITY CHANGE MEASUREMENTS ON PLUTONIUM–URANIUM FUEL ELEMENTS. R. C. Bannerman, H. H. W. Pitcher, and R. Richmond (United Kingdom Atomic Energy Authority. Reactor Group, Atomic Energy Establishment, Winfrith, Dorset, England). July 1964. 42p. Dep.; $1.20(BIS) 6s. (HMSO).

Reactivity change measurements were carried out in the graphite-moderated reactor HECTOR on plutonium–uranium fuel elements with a low ^{240}Pu content. The aim of the work was to develop a method in which measurements on small fuel samples (typically 18 in. long) could be used to check the validity of proposed methods of calculation for plutonium-bearing lattices. The experiments were carried out in a variety of lattices and demonstrated that at a lattice pitch of 8.5 in., which was used for the majority of the measurements, the results were not significantly affected by the lattice environment. In particular, the results showed that it is not necessary to use plutonium–uranium fuel in the lattice surrounding the sample but that uranium fuel with similar properties is adequate. The accuracy obtained corresponded to an error of 0.5% in k_∞ for a lattice containing the plutonium–uranium fuel. The results of the measurements were compared with the predictions of the TRACER method of lattice calculation. It was found that, at room temperature, there was no significant difference between the measured and calculated values of k_∞ but that, at temperatures in the range 400 to 450°C, the calculated value of k_∞ was about 1½% lower than the measured value. (auth)

3504 (AWRE-O-52/64) ON THE SOLUTION OF CERTAIN NEUTRONICS PROBLEMS BY WAY OF A SUITABLE ADJOINT PROBLEM. E. D. Pendlebury (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Oct. 1964. 17p. Dep.(mn).

Some neutronics problems can most conveniently be solved using a suitable adjoint problem, leading to a considerable saving in machine time. In many practical cases the machine time required may be reduced by a factor of order 10. The types of problem that can usefully be solved in this way are discussed together with the method of choosing the appropriate adjoint problem. (auth)

3505 (BNL-7823) APPROACH TO EQUILIBRIUM OF A NEUTRON PULSE IN GRAPHITE. Ajoy K. Ghatak and Henry C. Honeck (Brookhaven National Lab., Upton, N. Y.). Feb. 1964. Contract AT(30-2)-Gen-16. 7p. (CONF-446-44). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Nuclear Society 10th Annual Meeting, Philadelphia, June 1964.

Neutron density equations for graphite were solved. The times for approach to equilibrium are shown as a function of ^2B. (R.E.U.)

3506 (CEA-R-2229) ANALYSE DE LA PRECISION DE CERTAINES METHODES DE MESURE DES TRES BASSES REACTIVITES. (Analysis of the Accuracy of Certain Methods Used for Measuring Very Low Reactivities). Jean Valat and Thomas E. Stern (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). Aug. 1964. 77p. Dep.(mn).

The rapid measurement of reactivities, in particular very low ones (i.e., a few tens of β) appears to be an interesting method for the automatic startup a reactor and its optimization. The report explores the various methods studied essentially from the point of view of the time required for making the measurement with a given statistical accuracy, especially as far as very low activities are concerned. The statistical analysis is applied to methods for the natural background noise (autocorrelation and spectral density), the sinusoidal excitation methods for the reactivity or the source (with synchrone detection); and the periodic source excitation method using pulsed neutrons. The statistical analysis leads to the suggestion of a new method of source excitation using neutronic random square waves combined with an intercorrelation between the random excitation and the resulting output. (auth)

3507 (CEA-R-2230) GENERATION D'UN CRENEAU PSEUDO-ALEATOIRE PAR UN REGISTRE A DECALAGE A CONTRE-REACTION BINAIRE. (Production of a Pseudo-Random Square Wave Using a Shift Register With Binary Feedbacks). Thomas E. Stern, Jean Cazemajou, Bernard Macherez, Jean Valat, and Andre Vignon (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Aug. 1964. 42p. Dep.(mn).

The theoretical basis for the production of square waves having the values "1" or "0," the switching times being "pseudo-random," is summarized. More precisely, the square-wave may or may not change value at regular time intervals of length Δ, with probability approximately 0.5 for each alternative. The wave-form is obtained by means of a shift-register having modulo-2 feedback. If the interval Δ and the feedback connections are well chosen, it is possible to produce a waveform whose autocorrelation function is very close to a Dirac delta function. The square-wave therefore behaves like a quantized white noise, which has very interesting properties in cross-correlation techniques. (auth)

3508 (CEA-R-2454) ETUDE PRELIMINAIRE DE LA CINETIQUE D'UN REACTEUR PAR LA METHODE DES PROBABILITES. (Preliminary Studies of the Kinetics of a Reactor by the Probability Method). Jean-G. Bruna, Jean-Paul Brunet, Robert Caizergues, Christian Clouet d'Orval, and Philippe Verriere (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). June 1964. 23p. Dep.(mn).

The α decay constant of prompt neutrons was studied in the homogeneous plutonium-fueled, light-water-moderated reactor ALECTO, by the probability method. In this method, the probability to count one, two, etc., neutrons during a given time is measured. The value of α can be deduced from this measurement for various subcritical states of the reactor. The experimental results were then compared with values obtained, for the same reactivities, by the pulsed neutron technique. (auth)

3509 (CEA-R-2472) LES MOMENTS DE TRANSFERT D'ENERGIE EN THERMALISATION. (Energy Transfer Moments in Thermalization). Jean-Louis Soule and Denise Pillard (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Aug. 1964. 28p. Dep.(mn).

For all moderators of the "incoherent gaussian" type, it is possible to calculate, at any temperature, the energy transfer moments as a function of the incident energy without having to use the differential cross sections. Integral formulas are derived for the integral cross section. The first and the second moments, which make it possible to tabulate directly these three functions in a few minutes using IBM 7094, are for the most part from models proposed in the literature for the common moderators. (auth)

3510 (CEA-R-2473) MODÈLES SIMPLES POUR LES THERMALISEURS USUELS. (Simple Models for Common Thermalizers). Jean-Louis Soule (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Aug. 1964. Contract 037-60-12-RDF. 32p. Dep.(mn).

Calculations of thermal spectra in heterogeneous and homogeneous moderating materials using models for neutron scattering are discussed. Graphite, light water, heavy water, and beryllium are included. (R.E.U.)

3511 (CEA-R-2477) EXPERIENCES CRITIQUES DANS AQUILON PORTANT SUR DES COMBUSTIBLES LEGEREMENT ENRICHIS EN URANIUM 235 ET EN PLUTONIUM. (Critical Experiments in Aquilon With Fuels

Slightly Enriched in Uranium 235 or in Plutonium). Roger Naudet, Michel Chabrillac, Guy Ledanois, and Pierre Lourme (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). Aug. 1964. 27p. Dep.(mn).

Reactivity comparisons were made in Aquilon II between geometrically identical lattices differing only by the composition of the fuel. The fuel elements consist of metallic uranium single rods with either slight differences of the isotopic composition (0.69–0.71–0.83–0.86 per cent of uranium 235) or slight additions of plutonium (0.043 per cent). Five lattices pitches were used, in order to produce a large variation of spectrum. Two additional sets of plutonium fuels are prepared to be used in the same conditions. The double comparisons: natural-enriched versus natural-enriched plutonium, are made in such a way that a very precise interpretation is permitted. The results are perfectly consistent, which seems to prove that the calculation methods are convenient. Further it can be inferred that the usual data, namely for the ratio of the η of ^{235}U and ^{239}Pu seem reliable. (auth)

3512 (CEA-R-2487) MESURE DES SECTIONS EFFICACES EFFECTIVES D'ECHANTILLONS FISSILES PAR UNE METHODE D'OSCILLATION DANS LES ASSEMBLAGES CRITIQUES. (Measurement of Effective Cross Sections of Fissionable Samples in Critical Assemblies by an Oscillation Method). Oleg Tretiakoff, Rene Vidal, Jean-Claude Carre, and Michel Robin (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). Aug. 1964. Dep.(mn).

The technique used to measure the effective absorption and neutron-yield cross sections of a fissionable sample are described. These two values are determined by analyzing the signals due to the variation in reactivity (over-all signal) and the local perturbation in the flux (local signal) produced by the oscillating sample. These signals are standardized by means of a set of samples containing quantities of fissionable material (^{235}U) and an absorber, boron, which are well known. The measurements are made for different neutron spectra characterized by lattice parameters that constitute the central zone within which the sample moves. The technique is used to study the effective cross sections of uranium-plutonium alloys for different heavy-water and graphite lattices in the MINERVE and MARIUS critical assemblies. The same experiments are carried out on fuel samples of different irradiations in order to determine the evolution of effective cross sections as a function of the spectrum and the irradiations. (auth)

3513 (EUR-1914.e) AIREK-MOD: A MODIFIED VERSION OF THE KINETIC CODE AIREK II. Carla Mongini-Tamagnini (European Atomic Energy Community. Joint Nuclear Research Center, Ispra, Italy and European Atomic Energy Community. European Scientific Data Processing Center, Ispra, Italy). 1964. 33p. Dep.(mn).

Standard forms for the subroutines giving the reactivity versus time, the stop conditions, and the output specifications were developed. Besides the possibility of feedback variables, derivatives depending on feedback variables other than the one considered, were introduced. (auth)

3514 (GAMD-4131) MEAN EMISSION TIME CORRECTION FOR THE MEASUREMENT OF STATIONARY SPECTRA BY THE PULSED NEUTRON SOURCE TECHNIQUE. J. U. Koppel (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Apr. 1, 1963. Contract AT(04-3)-167. 7p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The correction for decay time in pulsed measurements of neutron spectra in multiplying and non-multiplying media is derived. (R.E.U.)

3515 (HW-82397) POWER SPECTRUM AND CROSS SPECTRUM ANALYSIS OF RANDOM SIGNALS. C. Metelmann and C. D. Swanson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 22, 1964. Contract AT(45-1)-1350. 17p. Dep.(mn); $1.00(cy), 1(mn) OTS.

To make kinetics measurements on reactors with the aid of tape-recorded neutron flux signals, a cross-spectrum and power-spectrum analysis is necessary. The basic unit for spectrum and cross-spectrum analysis operates on two time signals, which are used to compute the input and output power spectral densities, the cross co-power spectral density, and the cross quadrature power spectral density. The EASE 1132 analog computer is used for this work, and the simulation is modeled after the Boonshaft and Fuchs Model 711C d-c power and cross-spectrum analyzer. This setup requires a signal generator capable of generating sin ωt and cos ωt reference signals of constant amplitude and closely controlled phase. This generator is available through a transfer function analyzer and signal generator. which has a frequency range from 0.01 to 999 cps. (auth)

3516 (HW-83296) ANALOG COMPUTER SIMULATION FOR A PRCF LIGHT WATER Pu STUDY. C. Metelmann (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 14, 1964. Contract AT(45-1)-1350. 20p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The equations, values, and other pertinent information used in an analog study of nuclear excursions in the Plutonium Recycle Critical Facility with light water moderator are summarized. (R.E.U.)

3517 (IDO-16990) SELF-LIMITING EXCURSION TESTS OF THE SPERT II HIGHLY ENRICHED PLATE-TYPE D_2O-MODERATED REACTOR. PART IV. DATA SUMMARY REPORT. V. W. Goldsberry (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Sept. 1964. Contract AT(10-1)-205. 150p. Dep.; $4.00(cy), 3(mn) OTS.

The report, the fourth part of a four part series, is a documentation of experimental data from three series of tests performed in the Spert II reactor with D_2O moderator and highly enriched fuel. The tests consisted of step-wise insertions of excess reactivity under varying conditions ranging from ambient temperatures to $\approx 100°C$ and static pressure from atmospheric to ≈ 375 psig. The data obtained from these tests are presented in tabular form and as plots of the time behavior of reactor power, fuel plate surface temperature, pressure, compensated reactivity, and energy. Summary data figures displaying measured test data as functions of asymptotic reactor period also are included. (auth)

3518 (NP-14429) NUCLEAR REACTOR CALCULATIONS WITH THE GROUP DIFFUSION EQUATIONS ON DIGITAL COMPUTERS (thesis). W. J. Van de Lindt (Delft, Netherlands. Technische Hogeschool). 1964. 148p. Dep.(mn).

The neutron group diffusion equations are derived directly from the Boltzmann equation, allowing down-scattering into an energy level from all other higher levels. These group equations are then solved in two dimensions, with the help of a finite-difference method. To approximate the resulting differential equations by finite-difference equations, a nine point star of the Varga type is used. With this method a better neutron balance is obtained and a higher accuracy of the criticality results. In order to be able to show that a real single dominant eigenvalue exists, certain restrictions have to be imposed on the mesh size. For heterogeneous reactors a difficulty arises because at points on an interface, the source function defining the eigenvalue problem is not defined. The source is redefined in such a way that the total source in an interface is correct though the source for each group may still be incorrect. A computer program is described, with which it is possible to solve the equations in a domain of any shape and having interior regions of arbitrary shape, provided boundaries and interfaces can be approximated by line segments, coinciding with the mesh lines. An example of a two-group problem is given. A computational method is described that makes it possible to use alternating-direction iterations with tape limited problems. An acceleration method for the outer iteration is described. (auth)

3519 (PAN-533/IX-A) THERMAL UTILIZATION FACTOR IN THE ANNA REACTOR CELL. R. Bednarz and J. Mika (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). June 1964. 12p. Dep.

The one-velocity method of calculating the thermal utilization factor and neutron flux distribution in the "ANNA" reactor cell is presented. The method is based on the matrix formulation of the Amouyal-Benoist theory. The calculated neutron density distribution is compared with the experimental results. (auth)

3520 (RPI-328-9) LOCAL FLUX SHAPE DEPENDENCE ON REACTOR PERIOD. F. D. Judge, F. C. Merriman, and P. B. Daitch (Rensselaer Polytechnic Inst., Troy, N. Y.). [July 1964]. Contract AT(30-3)-328. 7p. (CONF-654-20). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

The dependence of fine-structure flux shapes and corresponding homogeneous effective Σ_a in pulsed heterogeneous assemblies on decay rates was studied. Monoenergetic transport calculations on specific repeating slab arrays are presented showing the effective cross sections to vary for fast reactor periods. (R.E.U.)

3521 (TID-21238) PROGRESSIVE SUBSTITUTION EXPERIMENTS IN UO_2 LATTICES MODERATED BY D_2O/H_2O MIXTURES. H. R. Frazen (Norway. Institutt for Atomenergi, Kjeller). Aug. 1964. 28p. (KR-90; NORA-21). Dep.(mn); $2.00(cy), 1(mn) OTS.

Buckling measurements for cores of uranium oxide (3% enriched) in different mixtures of D_2O/H_2O were performed in the NORA reactor by means of a progressive substitution technique. In order to check the results, some experiments were also carried out by the substitution technique in critical lattices for which the material buckling was already known. Some subcritical experiments were also performed to give additional information about the buckling obtained by substitution experiments. The analysis was done by three-region, two-group theory, and a correction was introduced in order to take into account the effect of the reflector. For a D_2O concentration of 99.50% and a lattice pitch of 6.544 cm, the material buckling with void was obtained by three-region, one group theory. All the results were found to agree satisfactorily with the results from critical experiments. Axial flux distributions were measured in some cases by using copper foils and a small fission chamber. (auth)

3522 OPTIMIZATION OF XENON POISONING BY MINIMIZATION OF THE ZENON PEAK. Yoshikumi Shinohara and Jean Valat. Compt. Rend., 259: 1623-6(Aug. 31, 1964). (In French)

The principle of the maximum of Pontryagin associated with some physical considerations permits determination of a program of optimum stoppage, leading to a given Xe peak, or determination of the minimum Xe peak corresponding to a stoppage of given duration. (tr-auth)

3523 SPACE DEPENDENT REACTIVITY EFFECT OF FISSION AND ABSORPTION. Tohru Haga and Iwao Kobayashi (Japan Atomic Energy Research Inst., Tokyo). J. Nucl. Sci. Technol. (Tokyo), 1: 246-54(Oct. 1964).

The reactivity effect of materials introduced into a critical reactor is generally a result of complex changes given to the system concerned. Emphasis was put on the space dependent reactivity effect of fuel, and its fission and absorption terms were separately measured. The effect of fuel enrichment on reactivity was also measured by using fuel elements of three different enrichments, 2.6, 0.71, and 0.28%. The analysis was made by three group perturbation equations and its applicability was carefully checked in comparison with experimental results. (auth)

3524 THEORETICAL FOUNDATIONS OF PARAMETER OSCILLATION MEASUREMENTS. G. Blaesser (EURATOM-CCR, Ispra, Italy). Nukleonik, 6: 251-5(Sept. 1964).

The influence of periodic changes of some localized reactor parameters (cross sections) on the output signal of a detector placed somewhere in the reactor is discussed from a general point of view. For the special case of thermal reactors, a procedure of determining independently the contributions of the absorption and production of neutrons to these oscillations is given. (auth)

3525 INFLUENCE OF ENERGY DEPENDENCE OF DIFFUSION COEFFICIENTS ON THE NEUTRON SPECTRUM IN HETEROGENEOUS REACTORS. Helmut Kunze (Technische Hochschule, Karlsruhe, Ger.). Nukleonik, 6: 256-62(Sept. 1964). (In German)

In previous work on the heavy-gas model in the diffusion approximation, methods were developed for calculation of the place-dependent neutron spectra in heterogeneous reactors. These were extended so that the energy dependence of the diffusion coefficient D could be considered. For D_2O as moderator, the neutron spectra in two typical, heterogeneous reactors with periodic, quadratic lattice construction for the fuel elements were calculated for various courses of energy dependence of the diffusion coefficient. In comparison with results for energy-independent D, the spectra on the boundary of the fuel was somewhat weaker. For reactors with natural uranium fuel this effect was negligibly small. The changes of the spectra in the moderator depended on the geometry of the reactor and the absorption strength of the fuel element. The influence of the value of stopping power of the moderator on the neutron spectrum was also investigated. (tr-auth)

3526 INHOMOGENEOUS PERTURBATION THEORY FOR LATTICE FUEL-CYCLE CALCULATIONS. Jeffery Lewins (British Army Royal Engineers, Glasgow). Trans. Am. Nucl. Soc., 7: 211(Nov. 1964).

3527 P-3 CALCULATIONS FOR RODS IN A CLOSED PACKED SQUARE LATTICE AND IN WIGNER-SEITZ EQUIVALENT CELLS. T. E. Dudley and P. B. Daitch (Rensselaer Polytechnic Inst., Troy, N. Y.). Trans. Am. Nucl. Soc., 7: 211-21(Nov. 1964). (RPI-328-11)

3528 MEASUREMENT OF THE TEMPERATURE DEPENDENCE OF THERMAL-DISADVANTAGE FACTORS IN LIGHT-WATER-MODERATED, 2.1%-ENRICHED UO_2 LATTICES. W. P. Wynn, Jr., E. B. Fehr, and E. Greenspan (Cornell Univ., Ithaca, N. Y.). Trans. Am. Nucl. Soc., 7: 212-13(Nov. 1964).

3529 PRELIMINARY ANALYSIS OF SOME $U^{233}O_2$–ThO_2–H_2O LATTICES. H. C. Honeck and B. R. Sehgal (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 214-15(Nov. 1964).

3530 ANALYSIS OF BNL UO_2–H_2O LATTICE EXPERIMENTS. B. R. Sehgal (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 215-16(Nov. 1964).

3531 CRITICAL MASSES AND BUCKLINGS OF PuO_2–UO_2–H_2O SYSTEMS. L. C. Schmid, R. C. Liikala, W. P. Stinson, and J. R. Worden (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 216(Nov. 1964).

3532 THE AGE OF FISSION NEUTRONS TO INDIUM RESONANCE ENERGY IN IRON–WATER MIXTURES. R. K. Paschall (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 217(Nov. 1964).

3533 SELF-SHIELDING OF CLOSELY-SPACED SLAB LATTICES. S. W. Kitchen and K. R. Edgar (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nucl. Soc., 7: 217-18(Nov. 1964).

3534 OPTIMAL FEEDBACK CONTROL OF SPATIAL XENON OSCILLATIONS. Donald M. Wiberg (General Dynamics/Astronautics, San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 219-20(Nov. 1964).

3535 CONTROL-INDUCED XENON OSCILLATIONS. S. G. Margolis and N. J. Curlee, Jr. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 220-1 (Nov. 1964).

3536 SOME NUMERICAL EXPERIMENTS COMPARING APPROXIMATE METHODS FOR REACTOR KINETICS ANALYSIS. J. B. Yasinsky, A. F. Henry, and W. G. Clarke (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 224-5(Nov. 1964).

3537 SPATIALLY-DEPENDENT TRANSFER FUNCTION FOR NUCLEAR SYSTEMS. Chester D. Kylstra and Robert E. Uhrig (Univ. of Florida, Gainesville). Trans. Am. Nucl. Soc., 7: 225-6(Nov. 1964).

3538 PHYSICS MEASUREMENTS ON A 600-LITER FAST-NEUTRON CARBIDE CORE. G. K. Rusch, E. R. Boehme, L. R. Dates, S. Grifoni, W. Y. Kato, G. W. Main, H. H. Meister, M. Nozawa, and R. L. Stover (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 236(Nov. 1964).

3539 PHYSICS MEASUREMENTS IN TUNGSTEN-BASED ALUMINUM-REFLECTED FAST REACTORS. R. C. Doerner, W. G. Knapp, and K. K. Almenas (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 236-7 (Nov. 1964).

3540 CALCULATIONS OF ZPR-III FAST ASSEMBLIES USING A TWENTY-SIX-GROUP CROSS-SECTION SET. D. Meneghetti and J. R. White (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 237-8(Nov. 1964).

3541 EFFECT OF A VOIDED GAP ON REACTIVITY COEFFICIENT FOR VOIDING CORE SODIUM IN A FAST REACTOR, FOR VARIOUS GEOMETRIES. L. C. Noderer and Sidney Visner (Combustion Engineering, Inc., Windsor, Conn.). Trans. Am. Nucl. Soc., 7: 238-9(Nov. 1964).

3542 PARAMETRIC ANALYSIS OF A U^{233}–THORIUM FAST-THERMAL, COUPLED SYSTEM. J. J. Prabulos, Jr. and Alexander Sesonske (Purdue Univ., Lafayette, Ind.). Trans. Am. Nucl. Soc., 7: 239(Nov. 1964).

3543 SODIUM-VOID-COEFFICIENT MEASUREMENTS IN A LARGE CARBIDE FAST ASSEMBLY. S. Grifoni, M. Nozawa, and W. Y. Kato (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 250-1(Nov. 1964).

3544 DOPPLER-EFFECT MEASUREMENTS IN PLUTONIUM-FUELED FAST ASSEMBLIES. G. J. Fischer, D. A. Meneley, and E. F. Groh (Argonne National Lab.. Ill.). Trans. Am. Nucl. Soc., 7: 252(Nov. 1964).

3545 OPERATIONAL MEASUREMENTS IN A TWO REGION (FAST-THERMAL) CRITICAL ASSEMBLY. F. G. Warzek, T. R. Jaworowski, and P. Meyer (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 7: 252-3(Nov. 1964).

3546 A GENERAL TIME-DEPENDENT PERTURBATION THEORY FOR REACTOR PHYSICS. R. B. Perez and F. J. Munno (Univ. of Florida, Gainesville.). Trans. Am. Nucl. Soc., 7: 255-6(Nov. 1964).

3547 VARIATIONAL ANALYSIS OF A NON-LINEAR KINETICS PROBLEM. David S. Selengut (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nucl. Soc., 7: 256-7(Nov. 1964).

3548 ESCAPE PROBABILITY FORMULATION FOR INTENSIVE REACTOR QUANTITIES. K. B. Cady, W. E. Schilling, and T. Tamai (Cornell Univ., Ithaca, N. Y.). Trans. Am. Nucl. Soc., 7: 257-8(Nov. 1964).

3549 INVARIANT IMBEDDING AND THE INTEGRATION TECHNIQUES OF REACTOR THEORY. S. Kaplan and E. M. Gelbard (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 258-9(Nov. 1964).

3550 A STABLE METHOD OF MATRIX FACTORIZATION. John W. Lucey and K. F. Hansen (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 7: 259(Nov. 1964).

3551 USE OF SUPERPOSITION PRINCIPLE IN MONTE CARLO RESONANCE ESCAPE CALCULATIONS. E. M. Gelbard and J. Spanter (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 259-60(Nov. 1964).

3552 BOUNDEDNESS AND FINITE ESCAPE TIME IN REACTORS WITH ARBITRARY LINEAR FEEDBACK. L. D. Noble and A. Z. Akcasu (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc., 7: 260-1(Nov. 1964).

3553 COLLISION PROBABILITIES WITH THE S_N APPROXIMATION. B. C. Quiquemelle (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 262(Nov. 1964).

3554 A COMPUTER INVESTIGATION OF DOPPLER DELAY IN MIXED OXIDE FUELS. V. W. Gustafson and R. E. Peterson (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 275-6(Nov. 1964).

3555 A GENERAL EQUATION FOR THE CROSS-CORRELATION OF THE COUNTS IN TWO SEPARATE TIME INTERVALS. James R. Sheff (Univ. of Washington, Seattle). Trans. Am. Nucl. Soc., 7: 278(Nov. 1964).

3556 A QUESTION REGARDING THE INTERPRETATION OF SPECTRAL-DENSITY MEASUREMENTS IN NUCLEAR REACTORS. R. K. Osborn (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 279-80(Nov. 1964).

3557 DETERMINATION OF REACTOR PARAMETERS BY SPECTRAL-DENSITY MEASUREMENTS. C. W. Ricker, D. N. Fry, and B. R. Lawrence (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 280-1(Nov. 1964).

3558 REACTIVITY MEASUREMENTS BY THE PULSED-NEUTRON TECHNIQUE. Noel Corngold (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 282-3(Nov. 1964).

3559 MEASUREMENT OF ROSSI-ALPHA IN REFLECTED REACTORS. R. A. Karam (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 283-4(Nov. 1964).

3560 PULSED NEUTRON MEASUREMENTS ON SOLID-MODERATED, SUBCRITICAL ASSEMBLIES OF ENRICHED URANIUM. John R. Morton, III (Univ. of California, Livermore). Trans. Am. Nucl. Soc., 7: 284-6(Nov. 1964).

3561 MONTE CARLO CALCULATIONS FOR ENRICHED URANIUM METAL ASSEMBLIES. D. C. Irving and John T. Mihalczo (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 287-8(Nov. 1964).

3562 APPLICATION OF MULTICHANNEL SYNTHESIS TO TWO-DIMENSIONAL DEPLETION CALCULATIONS. W. H. Turner, F. C. Merriman, and E. C. Hansen (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nucl. Soc., 7: 290(Nov. 1964).

3563 LEAST SQUARES VARIATIONAL ANALYSIS OF THE BURNUP PROBLEM. Martin Becker (Knolls Atomic Power Lab., Schenectady, N. Y.) and Henri Fenech. Trans. Am. Nucl. Soc., 7: 290-1(Nov. 1964).

3564 THE REPRESENTATION OF FEW-GROUP CROSS SECTIONS IN MULTIREGION DIFFUSION-DEPLETION CALCULATIONS. R. J. Breen (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 292-3 (Nov. 1964).

3565 TREC: A TIME-SHARING REACTOR CODE SYSTEM. K. F. Hansen and I. C. Pyle (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 7: 293-4(Nov. 1964).

3566 MATERIAL BUCKLINGS OF URANIUM–CARBIDE-FUELED GRAPHITE ASSEMBLIES— MEASUREMENTS. O. R. Hillig and D. W. Latham (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 295(Nov. 1964).

3567 MATERIAL BUCKLINGS OF URANIUM–CARBIDE-FUELED GRAPHITE ASSEMBLIES— THEORETICAL INTERPRETATION. Eugene R. Specht (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 295-6(Nov. 1964).

3568 ANISOTROPIC MIGRATION AREA MEASUREMENTS IN A D_2O-MODERATED LATTICE OF GAS-COOLED UO_2 ROD CLUSTERS. A. E. Dunklee and W. B. Rogers, Jr. (E. I. du Pont de Nemours & Co., Aiken, S. C.). Trans. Am. Nucl. Soc., 7: 297(Nov. 1964).

3569 MEASUREMENT OF $k_\infty(T)$ FOR A URANIUM FUEL ELEMENT. R. I. Smith (General Electric Co., Richland, Washington). Trans. Am. Nucl. Soc., 7: 297-8 (Nov. 1964).

3570 THE ANALYTICAL AND MONTE CARLO ANALYSIS OF AN EXPERIMENT DESIGNED TO ILLUSTRATE SPATIAL AND ENERGY INTERFERENCE AMONG RESONANCE NUCLIDES. N. R. Candelore and R. C. Gast

(Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 298-9(Nov. 1964).

3571 MTR PLUTONIUM LOADING ANALYSIS. J. J. Regimbal (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 299(Nov. 1964).

3572 ROD CLUSTER CONTROL ELEMENTS: COMPARISON BETWEEN ANALYSIS AND EXPERIMENT IN DETERMINATION OF WORTH. H. Aisu, H. T. Williams, Jr., W. J. Eich, and R. D. Leamer (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 299-300 (Nov. 1964).

3573 MEASUREMENT OF FLOODING CHARACTERISTICS, (β/l) AND POWER DISTRIBUTIONS IN THE MIXED SPECTRUM CRITICAL ASSEMBLY. G. T. Petersen, J. W. Hallam, T. R. Jaworowski, P. Meyer, and R. K. Haling (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 7: 300-1(Nov. 1964).

3574 MODERATED INTERMEDIATE-SIZED FAST OXIDE CORES. J. B. Nims, A. E. Klickman, E. M. Page, and C. S. Yeh (Atomic Power Development Associates, Inc., Detroit). Trans. Am. Nucl. Soc., 7: 304(Nov. 1964).

3575 PROPERTIES OF ALUMINUM REFLECTORS OF FAST CRITICAL ASSEMBLIES. K. Almenas, W. G. Knapp, and R. C. Doerner (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 304-5(Nov. 1964).

3576 A TRANSPORT-THEORY ANALYSIS OF A GASEOUS-CORE REACTOR CONCEPT. W. R. Butler and H. C. Chang (Aerojet-General Corp., Sacramento, Calif.). Trans. Am. Nucl. Soc., 7: 379-80(Nov. 1964).

3577 NEUTRON BEAM ATTENUATION AS AN OUT-OF-PILE VOID-FRACTION DETERMINATION TECHNIQUES. William T. Sha (Westinghouse Electric Corp., Pittsburgh) and Charles F. Bonilla. Trans. Am. Nucl. Soc., 7: 498-9(Nov. 1964).

3578 THE INFLUENCE OF SYSTEM PARAMETERS ON THE DYNAMIC RESPONSE OF A D_2O-MODERATED REACTOR. R. L. Johnson and J. A. Norberg (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 7: 500-1(Nov. 1964).

3579 STEAM VOLUME FRACTIONS IN FLOWING AND NON-FLOWING TWO-PHASE MIXTURES. William C. Meyer and John F. Wilson (Allis-Chalmers Mfg. Co., Milwaukee). Trans. Am. Nucl. Soc., 7: 507-8(Nov. 1964).

3580 PERTURBATION-METHOD EVALUATION OF THE HETEROGENEITY EFFECT IN A FAST REACTOR. F. Storrer (European Atomic Energy Community, Brussels), A. Khairallah, M. Cadillac, and P. Benoist. Trans. Am. Nucl. Soc., 7: 517(Nov. 1964).

3581 A METHOD FOR CALCULATING FLUX EVOLUTION IN A FAST-NEUTRON MULTIPLYING MEDIUM AS A FUNCTION OF TIME, SPACE AND ENERGY. F. Storrer (European Atomic Energy Community, Brussels), P. Govaerts, F. Ebersoldt, P. Hammer, and M. Stievenart. Trans. Am. Nucl. Soc., 7: 518(Nov. 1964).

3582 INVERSE PROBLEM IN NUCLEAR REACTOR THEORY. V. A. Chuyanov. Zh. Vychislitel. Mat. i Mat. Fiz., 4: 35-51(Jan.-Feb. 1964). (In Russian)

The problem is presented by first obtaining Pierl's equation in a convenient form and by expressing the parameters of this equation as functions of the neutron flux and the material properties of the reactor. The existence of nontrivial solutions is demonstrated for the nonlinear integral equation of the inverse problem and for specific limits (range of values) on the parameters of the equation. The uniqueness of positive solutions is also proven. The inverse problem is applied to the special geometry of an infinite flat slab. Also, a numerical solution is given for the inverse problem for a sphere. (TTT)

3583 CRITICALITY OF A REACTOR WITH A NONLINEAR RELATION BETWEEN THE TEMPERATURE AND NEUTRON FLUX IN THE APPROXIMATION OF THE ONE-VELOCITY TRANSFER EQUATION. O. B. Moskalev. Zh. Vychislitel. Mat. i Mat. Fiz., 4: 166-8(Jan.-Feb. 1964). (In Russian)

The transfer equation is rewritten in a convenient operational form, and the solution to the nonlinear case is expressed in terms of a solution to the linear problem by means of a recursion formula. The assumptions inherent in this formulation are discussed; and the conditions imposed on the parameters of the transfer equation—the conditions for which solutions are possible—are also discussed, including the conditions of continuity of the functional relation between temperature and neutron flux. (TTT)

Design and Feasibility

3584 STEAM SUPERHEAT BOILING WATER NUCLEAR REACTOR. Donald J. Stoker, Lisso Stuart Mims, and Sidney Siegel (to North American Aviation, Inc.). U. S. Patent 3,150,052. Sept. 22, 1964. Filed July 3, 1959.

A boiling-water reactor with nuclear superheat was designed. It consists of a two-region direct or dual cycle boiling water reactor with an integral nuclear superheater utilizing a solid moderator in the steam superheat region. Gross thermal efficiencies on the order of 40% were obtained and a conventionally designed steam turbine could be used. Only slightly enriched uranium is required throughout the core. Steam is generated in the first region of the core and superheated in the second region. (M.C.G.)

3585 LIQUID MODERATED NUCLEAR REACTORS SUBJECT TO VARYING MOVEMENTS. Pierre-Jean Ricard, Alfred Georges Jean Hirtz, and Michel Clayer (to Commissariat a l'Energie Atomique). U. S. Patent 3,152,047. Oct. 6, 1964. Priority date Aug. 22, 1958, France.

A method was developed for reducing irregularities in the operation of reactor with the irregularities are due to movements imparted to an assembly consisting of, for example, a liquid-moderated reactor, one or more heat exchangers in which the moderator liquid flows from the moderation zone as far as the inlet to the exchangers and from the outlet of the exchangers back to the reactor. The liquid-moderator circuit includes a means for flow control adapted to regulate the delivery of the moderator to the reactor vessel as a function of acceleration of the reactor upon movement of the reactor to reduce variation of the density of the liquid in the vessel consequent on such acceleration. The flow-control means consists of a valve, with the fist member defining a duct for liquid flow and the second member varying the cross section of the duct. (M.C.G.)

3586 NUCLEAR REACTORS. George Howard Forsyth (to Vickers-Armstrongs (Engineers) Ltd.). U. S. Patent 3,152,048. Oct. 6, 1964. Priority date Nov. 25, 1960, Great Britain.

A method was developed for controlling the reactivity of the core in a boiling-water reactor over the load range of the reactor. The method consists of withdrawing steam from the steam space of the reactor and passing the withdrawn steam through the reactor core. By varying the rate at which the steam is passed through the core, the reactivity can be controlled. (M.C.G.)

Fuels

Refer also to abstract 3503.

3587 (AECL-2102) PLUTONIUM FUELS FOR THERMAL REACTORS. O. J. C. Runnalls (Atomic Energy of Canada Ltd., Chalk River, Ont.). Oct. 1964. 16p. Dep.; $0.50(AECL).

There is evidence that plutonium recycling will be economic in thermal reactors, even in competition with fast reactors. Thermal reactors of the heavy-water-moderated pressure-tube type such as CANDU should prove par-

ticularly suitable as plutonium burners because of their high conversion ratio, good neutron economy, and proven ability for fuel changing at full power. The last advantage is of major significance at high fuel ratings and surface heat fluxes, where occasional sheath failures introduce the requirement of early removal of the defective fuel if gross contamination of the coolant circuit is to be avoided. Several alloys and ceramics appear suitable as vehicles for the recycle of plutonium to thermal reactors. For spike elements the most experience has been gained with aluminum–plutonium alloys. Irradiation tests show that satisfactory performance can be achieved in unbonded round-rod assemblies with both zirconium alloy and stainless steel sheaths at core temperatures as high as 600°C. Although zirconium–plutonium alloys have higher melting points this advantage over Al–Pu is vitiated by their much lower thermal conductivity. Hence there is little incentive to choose the more expensive Zr–Pu fabrication route unless a core-sheath metallurgical bond is required such as for flat plate elements. For uniform enrichment, mixtures of uranium and plutonium oxides receive the major attention. The economics would appear to favor the sintered pellet route, but vibratory compaction may result in cheaper fuel when a premium is placed on oxide of low density to achieve high heat ratings with molten cores. Mixtures of thorium and plutonium oxides may develop as a competitor for the natural or slightly enriched uranium fuel cycle. Thus further development of fabrication routes for ThO_2–PuO_2 and more extensive irradiation testing seem warranted. (auth)

3588 (GAMD-5004) OPTIMUM THICKNESS OF AN ANNULAR FUEL COMPACT YIELDING MINIMUM TEMPERATURE FOR A GIVEN HEAT FLUX. G. B. Melese (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Mar. 19, 1964. Contract AT(04-3)-187. 40p. (CONF-654-10). Dep.(mn); $2.00(cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

The optimum fuel concentration in an annular fuel compact is found to be about 50 volume % for small overall fuel fraction in the element (up to 25% in spine and compact) and small ratio of fuel-to-matrix thermal conductivities (up to 10%). These results are valid whether the maximum or the average fuel compact temperatures are minimized with respect to the geometry, and whether the thermal conductivity of the fuel compact varies with the fuel concentration according to a linear law, or to Maxwell's law. General results are derived with these two laws for all values of the ratio of thermal conductivities and of the overall fuel fraction. The geometry where there is no matrix material in the fuel compact (thinnest annulus) yields the lowest average and maximum temperatures when the ratio of thermal conductivities is above 50%, approximately. (auth)

3589 (HW-82043) PHYSICS STATICS CALCULATION RECIPES FOR PLUTONIUM BURNERS. P. L. Hofmann, G. J. Busselman, and R. H. Holeman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 28, 1964. Contract AT(45-1)-1350. 36p. Dep.(mn); $2.00(cy), 1(mn) OTS.

Some calculational methods for water-moderated, fairly epithermal, fully enriched, plutonium burners for criticality, excess reactivity, and long-term reactivity changes with fuel burnup are summarized. The procedures are included in the ZODIAC burnup code. A typical Pu burner (Mark I) was analyzed using three spectrum approximations: Wilkins, Wigner-Wilkins, and the Nelkin water kernel. Mark I was fueled with 80% ^{239}Pu and 20% ^{240}Pu, and is a Zr–H_2O plate-type 100-Mw reactor with a 500-liters core. (R.E.U.)

3590 APPLICATION OF FLUID FUELS IN NUCLEAR REACTORS. D. Naumann (Zentralinstitut für Kernforschung, Rossendorf, Ger.). Kernenergie, 7: 645-54(Sept. 1964). (In German)

A survey was made on the application of fluid fuels in nuclear reactors, such as aqueous homogeneous reactors, molten salt reactors, liquid metal fuel reactors, and fluidized bed reactors. Advances in fluid fuel reactors are discussed. (P.C.H.)

3591 FUEL ELEMENTS. Power Reactor Technol., 7: 354-64(1964).

The failures that occurred in the fuel elements which were irradiated in the VBWR during the Fuel Cycle Program are described. The cause of the presence of helium in the voids of irradiated oxide fuel elements is discussed. The development of stainless steel-lined Zircaloy-2-clad fuel rods and of boron-containing fuel elements is described. Use of electron-beam welding in fuel element fabrication is discussed briefly. Irradiation effects in UO_2 are reviewed. (D.L.C.)

3592 PLUTONIUM BURNUP DATA. D. E. Christensen, N. W. Brown, and W. A. Reardon (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 404-5 (Nov. 1964).

3593 ORDERED PACKED-BED FUEL ELEMENTS. H. Susskind, W. E. Winsche, and W. Becker (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 410(Nov. 1964).

3594 MOLTEN UO_2 FUEL ROD IRRADIATIONS TO HIGH BURNUP. M. F. Lyons, T. J. Pashos, B. Weidenbaum, C. R. Wilson, and D. L. Zimmerman (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 7: 411-12(Nov. 1964).

3595 OPTIMUM CONCENTRATION IN THE FUELED REGION OF A FUEL ELEMENT PRODUCING MAXIMUM HEAT FLUX. G. B. Melesse (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 433-4(Nov. 1964).

3596 MAXIMUM TEMPERATURES IN FLAT-PLATE FUEL ELEMENTS WITH FUEL-CLAD BONDING DEFECTS. D. S. Rowe (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 434-5(Nov. 1964).

3597 THE DIFFUSION OF BARIUM IN SIMULATED HIGH-TEMPERATURE GRAPHITE FUEL ELEMENTS. E. E. Anderson and L. R. Zumwalt (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 451-2(Nov. 1964).

3598 ADDITIONAL INFORMATION ON BOILING BURNOUT CONDITIONS FOR 19-ROD BUNDLE FUEL ELEMENTS. J. M. Batch (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 504(Nov. 1964).

3599 POTENTIALITIES OF MOLTEN UO_2 AS A REACTOR FUEL. B. Weidenbaum and S. Naymark (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 7: 527-8(Nov. 1964).

3600 IMPROVEMENTS IN FUEL ELEMENTS FOR NUCLEAR REACTORS. Maurice Gauthron, Marc Salesse, and Jacques Andre Stohr (to Commissariat à l'Énergie Atomique). British Patent 970,687. Sept. 23, 1964. Priority date Mar. 2, 1962, France.

A fuel element for high-temperature CO_2-cooled reactors is described. It consists of a UC or UC_2 core in an Al-steel sheath of ~0.1 mm thickness. This rod is centered by radial spacers within the channel. (T.R.H.)

3601 STRAIN INDICATORS FOR NUCLEAR REACTOR FUEL ELEMENTS. David William Williams (to United Kingdom Atomic Energy Authority). U. S. Patent 3,147,190. Sept. 1, 1964. Priority date Sept. 4, 1959, Great Britain.

A strain indicator is designed for detecting the swelling of the sheath of a fuel element due to oxidation of the fuel by coolant entering a breach in the sheath. The strain indicator comprises a stainless steel capillary tube containing a uranium wire and fitted around the fuel element in such a way that swelling of the sheath pulls the tube apart and exposes the uranium wire. Subsequent detection of the released fission products provides indication of the sheath failure. (D.L.C.)

3602 NUCLEAR REACTOR FUEL ELEMENTS. William Selwyn Robson (to United Kingdom Atomic Energy Authority). U. S. Patent 3,147,193. Sept. 1, 1964. Priority date Mar. 2, 1960, Great Britain.

An end attachment is designed for restraining a gas-cooled reactor fuel element against coolant-flow-induced vibration. The end attachment is provided with three radially projecting arms, two of which are of fixed effective radial length and the third arm having resilient means (spring-loaded bellows) tending to extend the arm. (D.L.C.)

3603 NUCLEAR REACTOR FUEL ELEMENTS. Ernest Smith (to United Kingdom Atomic Energy Authority). U. S. Patent 3,147,194. Sept. 1, 1964. Priority date Mar. 2, 1960, Great Britain

An end attachment for a gas-cooled reactor fuel element is designed which restrains the fuel element against vibration in the reactor channel. The end attachment, which is attached to the upper end of the fuel element, comprises several pivoted, projecting support members, whose effective radial length is adjustable so as to contact the wall of the channel. (D.L.C.)

3604 NUCLEAR REACTOR FUEL ELEMENTS. Kenneth Henry Dent and William Charles Leonard Kent (to United Kingdom Atomic Energy Authority). U. S. Patent 3,150,056. Sept. 22, 1964. Priority date Oct. 10, 1960, Great Britain.

A fuel element was designed with an elongated form and an end termination member secured to one end. Three radially projecting arms were on the end termination member. Two of the arms were fixed and of fixed effective radial length. The third arm had a part pivoted to the end termination member. A compression spring extends between the pivoted part and the fixed body of the third arm to extend its effective radial length so that a lateral force can be applied to center the fuel element in the fuel channel. (M.C.G.)

3605 VITREOUS MATERIALS AND THEIR APPLICATION TO NUCLEAR REACTORS. André H. Pons (to Compagnie de Saint-Gobain). U. S. Patent 3,150,099. Sept. 22, 1964. Priority date Dec. 30, 1958, France.

Methods are described for preparing glasses that effectively lend themselves to the manufacture of nuclear fuels in the shape of uranium- and thorium-containing micro-beads. They are prepared so that they contain no elements showing a large cross section with respect to neutrons and so that they are little affected by heavy water at a temperature of 300°C. The glasses are composed of 25 to 35% SiO_2, 10 to 25% TiO_2 + ZrO_2, 20 to 40% alkaline earth oxides + ZnO + MgO + BeO, and 20 to 45% UO_2 and/or ThO_2. (M.C.G.)

3606 NUCLEAR REACTOR FUEL ELEMENTS. Leslie Mark Wyatt (to United Kingdom Atomic Energy Authority). U. S. Patent 3,151,035. Sept. 29, 1964. Priority date July 22, 1958, Great Britain.

A fuel element design is offered which provides for clad cylindrical elements to be coupled in a long stack. Depleted uranium caps reduce neutron flux between elements. The arrangement allows for different radial expansions of the different materials. (T.R.H.)

3607 HIGH TEMPERATURE REACTOR FUEL ELEMENT. Edward F. Weisner, Charles C. Woolsey, Jr., and Ralph J. Gimera (to North American Aviation, Inc.). U. S. Patent 3,152,049. Oct. 6, 1964. Filed Aug. 29, 1960.

A fuel element was designed, which consists of spaced, clad fuel plates with side members of the cladding material (aluminum or magnesium) supporting the fuel plates to form a hollow box assembly. Metal supports are provided to minimize dimensional instability of the assembly. A pair of grid plates define the length of the core and the fuel elements are removably supported in the hollow, perforated support means. (M.C.G.)

3608 FUEL ELEMENTS FOR NUCLEAR REACTORS. Donald Williams (to United Kingdom Atomic Energy Authority). U. S. Patent 3,157,580. Nov. 17, 1964. Priority date Jan. 19, 1960, Great Britain.

A fuel element is described which gives early warning of leaks. A Mg capsule containing radioactive Kr or Rn is in a hole in the center of the fuel slug. If safe temperatures are exceeded the capsule releases the gas to the coolant monitoring system. (T.R.H.)

3609 FUEL ASSEMBLY FOR NEUTRONIC REACTOR. Wayne D. Fowler (to U. S. Atomic Energy Commission). U. S. Patent 3,158,549. Nov. 24, 1964.

A fuel assembly is described, comprising a rectangular open work base and upwardly extending corner members and an upper rectangular frame defining an opening. Grid wires space and position the rods, and a grating and locking handle retain the fuel rods therein. (AEC)

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Refer also to abstracts 3486 and 3587.

3610 (AECL-1930) ANALYSIS OF BOILER ROOM PRESSURES FOLLOWING POTENTIAL RUPTURE OF THE MAIN COOLANT LINE IN THE NUCLEAR POWER DEMONSTRATION (NPD-2) PLANT. Report No. 169/79. (Dilworth, Secord and Associates Ltd., Toronto). Feb. 12, 1960. For Canadian General Electric Co., Ltd. Civilian Atomic Power Dept., Peterborough, Ont. 79p. Dep.; $2.00(AECL).

A theoretical and numerical determination of the maximum pressure rise and relevant pressure history, which would result in the boiler room of the Nuclear Power Demonstration (NPD-2) Power Plant from the complete failure of a main sixteen inch heavy water coolant pipe, is presented. Preliminary consideration suggested that the pressure relief duct leading from the boiler room should be made as short as possible. Subsequently this duct length was reduced from 150 feet to 50 feet. A simplified analysis based on the assumption of steady-state efflux from the boiler room through the 50 foot relief duct with a 9 foot by 12 foot cross section indicated that the maximum pressure rise would be limited to about 2 psig. On the other hand, a second such analysis based on the assumption of a closed boiler room with no outflow indicated a very rapid rate of pressure rise in the room leading to a peak pressure in excess of 45 psig. It was evident from these preliminary studies that the problem should be analyzed as a transient pressure phenomenon and the ensuing investigation was, therefore, based on this premise. The boiler room and pressure relief duct are represented by a mathematical model based on one-dimensional flow in order to study the transient pressure rise following the initiation of failure. Step-by-step numerical calculations were carried out for the flow in this one-dimensional model. The analysis also postulates a sealing diaphragm at the upstream end of the pressure relief duct, which would disintegrate within 20 milliseconds after the boiler room pressure reaches 1.5 psig. The pressure time-history determined by this analysis shows a rapid rate of pressure rise from the instant of failure leveling off to a peak of 4.4 psig after approximately 0.3 seconds. The numerical analysis was terminated shortly beyond the point of maximum pressure and does not therefore yield a specific pressure time-history beyond this point. A qualitative assessment of the various factors influencing the problem indicates, however, that the boiler room pressure would fall off gradually for 2.7 seconds beyond the peak until the stored mass of coolant is fully expelled and thereafter decay rapidly to ambient atmospheric pressure. The simplifying assumptions applied to the analysis are such that these results are considered to be somewhat over-conservative. (auth)

3611 (ASTRA-G-39.2) THOUGHTS ON THE MERITS OF A STEAM POWER SYSTEM FOR LUNAR BASE OPERATION. (Astra, Inc., Raleigh, N. C.). May 11, 1964. 6p.

A brief discussion is presented of steam power systems and their possible use on the moon. The requirements for lunar base operation are reviewed, and the advantages of steam systems over liquid-metal systems are emphasized. The different components of the steam systems are discussed: turbine, radiator, and reactor. The problems involved in the development of steam power systems for moon use are considered, and it is concluded that such development should be recommended. (D.L.C.)

3612 (CEA-R-2345) CONTRIBUTION A L'ETUDE DU REGLAGE DU DEBIT POUR LES REACTEURS INDUSTRIELS REFROIDIS PAR GAZ. (Contribution to the Study on the Flow-Rate Adjustment for Gas-Cooled Power Reactors). Bernard Milliot (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). 1964. 140p. Dep.(mn).

Thesis submitted to Université, Paris.

The adjustment of the coolant flow rate in a reactor channel as a function of the corresponding heat transfer equations and of the spatial and temporal neutron flux is discussed. An adjustment method using the envelope of possible flux curves is developed. Technological and economic advantages of this type of adjustment are discussed. The precision of the adjustment systems of the Marcoule reactors G1 and G2 is demonstrated. The second part of the thesis, entitled "Evolution of Nuclear Properties of Fuel in a Heterogeneous Thermal Reactor," includes a bibliographic study of nuclear calculations for use in fuel burnup studies. (R.E.U.)

3613 (CEA-R-2450) RAPSODIE — POINT DES ETUDES NEUTRONIQUES, HYDRAULIQUES, THERMIQUES ET DYNAMIQUES ET DES ETUDES DE STABILITE AU DEBUT DE L'ANNEE 1963. (Rapsodie — Neutronic, Hydraulic, Thermal and Dynamics Studies and Studies of Stability, Early in 1963). (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Fontenay-aux-Roses). Aug. 1964. 100p. (EUR-1807.f). Dep.(mn).

Studies relating to the choice between a U–Pu–Mo alloy fuel double-clad with Nb and stainless steel and UO_2–PuO_2 mixed oxide for Rapsodie are presented. Physics aspects of the two cores were studied: neutron flux and spectra, reactivity worths of control rods, neutron balance, specific power, delayed neutron effective fraction, prompt neutron lifetimes, and reactivity coefficient. Hydraulic studies included pressure-drop and sub-assembly lifting, force measurements, and vibration and pin flow distribution. Thermal considerations for the sodium coolant and alloy or oxide fuels are discussed. Dynamics calculations including the maximum credible accident show inherent stability for every envisaged reactor power for either core. (R.E.U.)

3614 (CEA-R-2465) ETUDE DES PERTES DE CHARGE DANS LA GRAPPE EL 4. (Study of Pressure Losses in the EL 4 Cluster). Charles Berriaud (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Aug. 1964. 61p. Dep.(mn).

The evolution of research on the EL-4 cluster is examined from the pressure losses point of view. These may be split up into separate pressure losses along the rods and in pressure losses corresponding to various particularities of the cluster. Tests were carried out on series of three or four clusters placed in a channel. Water was first used, and then carbon dioxide at 60 bars. In all cases the following two parameters were varied: the Reynolds' number, and the rotation of a cluster around its axis with respect to the surrounding clusters. The influence of the gap between to successive clusters was also studied. The first tests were carried out on clusters without jackets, the subsequent ones on clusters fitted with jackets. It was thus possible to study various types of element assemblies. The results are given in the form of curves representing the evolution of the independent pressure loss coefficients as a function of the Reynolds number. (auth)

3615 (CEA-R-2480) LES INSTABILITES SPATIALES DU FLUX ET LEUR CONTROLE DANS LES REACTEURS DE PUISSANCE GRAPHITE–GAZ. (Spatial Flux Instabilities and Their Control in the Graphite–Gas Power Reactors). Jean-Louis Cailly (France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucléaires, Saclay). 1964. 45p. Dep.(mn).

Radial-azimuthal and axial spatial flux instabilities in graphite–gas reactors are studied by means of an analytical approach. Results are checked with those which are given by two dimensional (r, z and r, θ) kinetic models programmed for an IBM 7094 computer. Conclusions on the control of instabilities obtained from these models are reported. (auth)

3616 (CEA-R-2500) ETUDES DE PERFECTIONNEMENTS AUX SYSTEMES D'ALIMENTATION EN GAS D'UN REACTEUR MODERE A L'EAU LOURDE. (Studies on Improvements in Gas Supply Systems for Heavy-Water Moderated Reactors). Gilles Aubert, Jean-Marc Hassig, Noel Laurent, and Bernard Thomas (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). July 1964. 34p. Dep.(mn).

In a heavy-water moderated reactor cooled by pressurized gas, an important problem from the point of view of the reactor block and its economics is the choice of the gas supply system. In the pressure tube solution, the whole of the reactor block structure is at a relatively low temperature, whereas the gas supply equipment is at that of the gas, which is much higher. These parts, through which passes the heat-carrying fluid have to present as low a resistance as possible to it so as to avoid costly extra blowing power. They may only be placed in the reactor block after it has been built; the time required for putting them in position should therefore not be too long. The work reported concerns the various problems arising in the case of each channel being supplied individually by a tube at the entry and the exit that is connected to a main circuit made up of large-size collectors. This individual tubing is sufficiently flexible to absorb the differential expansion and the movement of its ends without stresses or prohibitive reactions being produced; the tubing is also of relatively short length so as to reduce the pressure head of the pressurized gas outside the channels; the small amount of space taken up by the tubing makes it possible to assemble it in a manner satisfactory from the point of view both of the time required and of the technical quality. (auth)

3617 (CEA-R-2501) CONCEPTION GENERALE ET PRINCIPAUX PROBLEMES D'UN REACTEUR DE PUISSANCE "EAU LOURDE-GAZ" CONTENU DANS UN CAISSON RESISTANT. (General Design and Main Problems of a Gas–Heavy Water Power Reactor Contained in a Pressure Vessel). Roland Roche and Jean-Claude Gaudez (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). 1964. 39p. Dep.(mn).

In the framework of research carried out on a CO_2-cooled power reactor moderated by heavy water, the so-called "pressure vessel" solution involves the total integration of the core, of the primary circuit (exchangers and blowers), and of the fuel handling machine inside a single, strong, sealed vessel made of pre-stressed concrete. A vertical design was chosen: the handling "attic" is placed above the core, the exchangers being underneath. This solution makes it possible to standardize the type of reactor moderated by heavy water or graphite and cooled by a downward stream of carbon dioxide gas; it has certain advantages and disadvantages with respect to the pressure tube solution and these are considered in detail in the report. Extrapolation presents particular problems due specifically to the heavy water (for example its cooling, its purification, the balancing of the pressures of the heavy water and of the gas, the assembling of the internal structures, the height of the attic, etc.). (auth)

3618 (CEA-R-2504) UTILISATION DU CADMIUM EN SOLUTION DANUS LE MODERATEUR DU REACTEUR EL 4 FIXATION IRREVERSIBLE DU CADMIUM SUR LES SURFACES METALLIQUES. (Use of Cadmium in Solution in the EL 4 Reactor Moderator Irreversible Fixing of Cadmium on the Metallic Surfaces). Odette Croix, Odette Paoli, Jean Lecomte, and Lucien Dolle (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). Aug. 1964. 43p. Dep.(mn).

In the framework of research into the poisoning of the EL-4 reactor by cadmium sulfate, measurements were made by two different methods of the residual amounts of cadmium liable to be fixed irreversibly on the surfaces in contact with the heavy water. A marked influence of the pH was noticed. The mechanism of the irreversible fixing is compatible with the hypothesis of an ion-exchange in the surface oxide layer. In a sufficiently wide range of pH the cadmium thus fixed causes very little residual poisoning. The stability of the cadmium sulfate solutions is however, rather low in the conditions of poisoning. (auth)

3619 (64-CNA-101) CANADIAN NUCLEAR ASSOCIATION RESEARCH AND DEVELOPMENT BRIEF FOR INDUSTRY AND GOVERNMENT on the theme RESEARCH AND DEVELOPMENT ACTIVITY TO IMPROVE CANADIAN INDUSTRIAL CAPABILITY TO DESIGN AND SUPPLY NUCLEAR POWER SYSTEMS OF THE HEAVY WATER CONCEPT. (Canadian Nuclear Assn., Toronto). Mar. 1964. 30p. Dep.(mn).

Research and development activities related to the Heavy Water Moderated Power Reactor Program of the Canadian Nuclear Association are reviewed. (R.E.U.)

3620 (GA-3561) EXPERIMENTAL BERYLLIUM OXIDE REACTOR PROGRAM. Quarterly Progress Report for the Period Ending September 30, 1962. (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Oct. 26, 1862. Contract AT(04-3)-187. 53p. Dep.(mn); $3.00(cy), 1(mn) OTS.

The development of a gas-cooled, BeO-moderated reactor for use in conjunction with a closed-cycle gas turbine or a steam cycle for a small land-based or a maritime power plant is discussed. Progress is reported on reactor components development, reactor physics studies, materials development, and construction engineering. (R.E.U.)

3621 (GA-3830) EXPERIMENTAL BERYLLIUM OXIDE REACTOR PROGRAM. Quarterly Progress Report for the Period Ending December 31, 1962. (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Jan. 29, 1963. Contract AT(04-3)-187. 78p. Dep.(mn); $3.00(cy), 2(mn) OTS.

Progress is reported in the following fields of the Experimental Beryllium Oxide Reactor program: reactor development, reactor physics, materials development, construction engineering, and advanced concepts and application studies. (D.L.C.)

3622 (GAMD-4447) ESTA—EBOR SYSTEM TRANSIENT ANALYSIS, CODE DESCRIPTION AND RESULTS. J. B. Dunlay and J. E. Gratteau (General Atomic Div., General Dynamics Corp., San Diego, Calif.). July 30, 1963. Contract AT(04-3)-187. 139p. Dep.(mn); $4.00(cy), 3(mn) OTS.

The EBOR System Transient Analysis code for IBM 7090 is described in detail. The system is capable of "near" steady-state and transient analyses of reactor scram, ramp and step changes in reactivity, step changes in core outlet demand temperature, step changes in the fractional open position of either valve, helium flows at constant rates, step changes in the cooler outlet demand temperature, and step changes in the air flow through the cooler. Results are shown for program application. (R.E.U.)

3623 (GAMD-4592) BREEDING POTENTIAL OF THE TARGET 1000-Mwe HTGR. H. B. Stewart and J. R. Triplett (General Atomic Div. General Dynamics Corp., San Diego, Calif.). Sept. 20, 1963. Contract AT(04-3)-167. 19p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Breeding ratios were calculated for fuel elements containing BeO and graphite central spines. Results are presented to show the effect of fuel fabrication cost, fuel residence time in the reactor, and variations in fuel element design. The recycle fuel management program for bred uranium is discussed. Uranium-236 and ^{237}Np build-up are considered. (R.E.U.)

3624 (GAMD-5049(Rev.)) TARGET PRE-STRESSED CONCRETE VESSEL CEILING MODEL EXPERIMENTAL STRESS ANALYSIS. Condition No. 1—Radial Load at the Edge. D. C. Cornell and C. Riparbelli (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Aug. 14, 1964. Contract AT(04-3)-167. 33p. Dep.(mn); $2.00(cy), 1(mn) OTS.

A Plexiglas plate model of the concrete vessel ceiling for the 1000-Mw(e) TARGET reactor was subjected to uniform radial tension at its edge. Strain distribution in the perforated plate was studied. (R.E.U.)

3625 (GEAP-4476(Vol.I)) 1000-MWe BOILING WATER REACTOR PLANT FEASIBILITY STUDY. VOLUME I. (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Feb. 14, 1964. Contract AT(04-3)-189. 79p. Dep.(mn); $3.00(cy), 2(mn) OTS.

For drawings in this report see CAPE-1203.

A summary report of the 1000-Mw(e) Boiling Water Reactor Plant Feasibility Study is presented. Included in volume 1 are chapters dealing with the scoping and ground rules, the design criteria, future development potential, and conclusions. Also included are summaries of the plant economics and the equipment descriptions. Volume 2 presents the detailed technical description of a 1000-Mw Electric Power Plant employing one or two boiling-water reactors as the steam source. The design, operation, and maintenance of the reference plant which employs one single-cycle boiling-water reactor with internal steam separation, flow control, pressure suppression containment, and wet refueling, feeding saturated steam to twin non-reheat turbine generators are discussed. Alternate designs, differing from the reference design in that they incorporate twin reactors and/or steam reheat, are considered. Volume 3 contains the Appendices and a complete set of drawings related to the 1000-Mw(e) Boiling Water Reactor Plant Feasibility Study. (auth)

3626 (GEAP-4476(Vol.II)) 1000-MWe BOILING WATER REACTOR PLANT FEASIBILITY STUDY. VOLUME II. (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Feb. 14, 1964. Contract AT(04-3)-189. 142p. Dep.(mn); $4.00(cy), 3(mn) OTS.

3627 (GEAP-4476(Vol.III)) 1000-MWe BOILING WATER REACTOR PLANT FEASIBILITY STUDY. VOLUME III. (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Feb. 14, 1964. Contract AT(04-3)-189. 220p. Dep.(mn); $6.00(cy), 4(mn) OTS.

For drawings in this report see CAPE-1203.

3628 (GEAP-4598) FLARE—A THREE-DIMENSIONAL BOILING WATER REACTOR SIMULATOR. D. L. Delp, D. L. Fischer, J. M. Harriman, and M. J. Stedwell (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). July 16, 1964. Contract AT(04-3)-361. 95p. Dep.(mn); $3.00(cy), 2(mn) OTS.

FLARE calculates a nodal power density for a three-dimensional core geometry, and was developed for the Consumers Big Rock Point research program. The model is based on a modification to one-group diffusion theory in which only the parameters k_∞ and the migration area M^2 are involved. An additional simplification involves the replacement of the reflector by an albedo at the core surface so that only mesh points within the active fuel region are considered. With one mesh point horizontally at the center of each fuel element, and six mesh points vertically, the 84-element Big Rock Point core is represented by 504 mesh points or nodes. The calculation consists of four levels of iteration, each higher level iteration being based on the converged solution of the next lower level. The levels are: source or power; void; control rod positioning; and fuel burnup. A sample problem is shown. (R.E.U.)

3629 (GEAP-4620) MIXED SPECTRUM SUPERHEAT CRITICAL EXPERIMENTS. THERMAL CORE MEASUREMENTS. G. T. Petersen, F. G. Warzek, H. F. Johnston, T. R. Jaworowski, J. W. Hallam, and P. Meyer (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). June 1, 1964. Contract AT(04-3)-189, 66p. Dep.(mn); $3.00(cy), 2(mn) OTS.

A critical experiment program was undertaken to provide

the physics information required to demonstrate the feasibility of the Mixed Spectrum Superheat Reactor (MSSR) concept and to proceed with the detailed design and construction of a prototype reactor. The MSSR consists essentially of an annular boiling-water reactor coupled with a centrally located fast-spectrum superheater reactor. Initial measurements without the fast core present were completed and analyzed. Measurements performed include: critical size, fuel worth, temperature effect, β/l, safety sheet worth and power distribution. The experimental results are compared to analytic predictions using engineering design methods previously developed for boiling-water reactors. In general, the agreement between experiment and theory was found to be excellent and no revisions on the analytic model are recommended. (auth)

3630 (HPR-20) VOID EFFECTS ON FLUX DISTRIBUTIONS IN HBWR WITH THE FIRST FUEL CHARGE. K. Bryhn-Ingebrigtsen, H. Smidt Olsen, N. Standal, and V. Tosi (Norway. Institutt for Atomenergi. OECD Halden Reactor Prosjekt). June 1964. 29p. Dep.(mn).

The influence of steam void on the macroscopic flux distribution was investigated. Experimentally, it was found that at 5 Mw and a primary steam pressure of 4.8 ata, the maximum of the thermal and fission axial flux distributions at the core axis is depressed by (12 ± 2) cm toward the bottom of the reactor. At a radial distance of 97 cm from the core axis the corresponding depression was determined to be (4 ± 2) cm. Intracell flux measurements in a completely voided coolant channel at low power show distortion even beyond the equivalent cell boundary. The axial flux and void distribution in boiling condition was calculated by a one dimensional, one group method. The agreement with the experimentally determined flux distribution is reasonable. P_3 calculations were carried out for the intracell thermal-neutron flux distribution without and with 100% void in the fuel coolant channel. The agreement with measurements is reasonable in the case of no void. Some discrepancies seem to exist with void in the channel. (auth)

3631 (HPR-34) REACTIVITY TEST AND EXPONENTIAL EXPERIMENTS WITH HBWR SECOND CHARGE FUEL ELEMENTS. H. Smidt Olsen (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). June 1964. 30p. Dep.(mn).

HBWR is a natural circulation, boiling, heavy water reactor, built to provide operational experience and information on the properties of this type of reactors. Buckling measurements made as a function of the moderator-to-fuel volume ratio and quality tests carried out with HBWR second charge fuel elements are discussed. The buckling measurements were performed in the Swedish exponential facility ZEBRA, while the quality tests were made in the Swedish zero power critical facility R-O. The material bucklings of various open hexagonal lattices were determined by flux distribution measurements in the exponential assembly ZEBRA. For a moderator-to-fuel ratio of 23 to 63, corresponding to that of the HBWR lattice, the measurements gave a material buckling of $(15.96 \pm 0.30)m^{-2}$. The value is slightly smaller than the predicted value of 16.34 m^{-2}. The temperature coefficient of the material buckling in the temperature interval from 20 to 85°C for the HBWR lattice was determined to $-(0.020 \pm 0.004)$ $m^{-2}/°C$ in good agreement with the theoretical value of -0.023 $m^{-2}/°C$. The reactivity controlled by one fuel element placed close to the central position of the R-O lattice was measured for each of 25 randomly selected second fuel charge elements. The standard deviation from the mean value was found to be 0.39%. (auth)

3632 (HPR-35(Vol.I)) DEVELOPMENT AND APPLICATIONS OF IN-CORE INSTRUMENTATION AT HBWR. VOLUME I. (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). Aug. 1964. 272p. Dep.(mn).

The development and applications of in-pile instrumentation for the Halden Boiling Water Reactor second fuel charge are discussed in 17 papers (two volumes), each of which was abstracted for NSA. (R.E.U.)

For abstracts of individual sections see: 3633, 3634, 3635, 3636, 3637, 3638, 3639, 3640, and 3641.

3633 (HPR-35(Vol.I)(Sect.1)) THE HBWR ATTITUDE ON IN-CORE INSTRUMENTATION. R. D. Smith (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 19p.

The evolution and the significance of the in-core instrumentation program are discussed. The instruments developed and applied can be used, and are needed, to reduce nuclear power costs through elimination of unnecessarily conservative limits on specific power. An evaluation of the large economic incentive for in-core instruments in the above application is presented. (auth)

3634 (HPR-35(Vol.I)(Sect.2)) PAST, PRESENT AND FUTURE INSTRUMENTED FUEL ASSEMBLIES AT HBWR. Ivar Devold (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 27p.

The historical development of the four instrumented fuel assemblies at HBWR and the improvements made during their development are reported. The plans for a group of instrumented tubular fuel elements for hydrodynamic measurements are described and the scope of the instrumented fuel irradiation test program is covered. (auth)

3635 (HPR-35(Vol.I)(Sect.3)) IFA-4 RESULTS SHOW THAT INSTRUMENTED FUEL ASSEMBLIES ARE NEEDED TO DETERMINE REAL REACTOR POWER LIMITS. O. Vapaavuori (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 42p.

Natural circulation experiments were performed with four instrumented fuel assemblies at HBWR. The fourth assembly had 6% enriched fuel enabling a higher channel power level to be obtained than previously. Improved experimental technique permitted continuous computer calculations and recording of the required parameters during the experiments. Channel flow oscillations occurring during natural circulation are discussed. A comparison of the results obtained with available out-of-pile loop experimental data shows that the prediction of assembly behavior in a reactor from loop data has severe limitations. (auth)

3636 (HPR-35(Vol.I)(Sect.4)) DEVELOPMENT AND USE OF IN-CORE INSTRUMENTS IN ELECTRICAL MOCK-UPS. H. N. van Leeuwen (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 23p.

The problems of simulating in-pile fuel assembly performance in out-of-pile loops, and the methods adapted to improve simulation and also to develop in-core instruments are dealt with. Experiments were performed with an electrically heated tubular test element and a duplicate of the fourth instrumented fuel assembly. (auth)

3637 (HPR-35(Vol.I)(Sect.5)) FORCED CIRCULATION BOILING INVESTIGATIONS IN AN INSTRUMENTED FUEL ASSEMBLY AT HBWR. A. G. Debbage (Norway. Institutt for Atomenergi. OECD Halden Reactor Prosjekt). 44p.

Forced circulation boiling experiments were made with the fourth instrumented fuel assembly at HBWR. The method developed was to continuously vary the boiling boundary along the channel length with continuous computer calculation and recording of the varying parameters. The controlled parameters were channel power and inlet velocity, the principal computed values being exit steam quality, void fraction, and slip ratio. The data obtained together with a preliminary analysis are reported. (auth)

3638 (HPR-35(Vol.I)(Sect.6)) POWER MEASUREMENTS IN A NATURAL CIRCULATION BOILING CHANNEL. B. Aarset (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 19p.

Remote-controlled calibration valves, which permit either forced or natural circulation in a fuel channel, were designed and installed in four instrumented fuel assemblies. Forced circulation permits boiling suppression and enables precise power calibration to be obtained, and repeated if desired during the assembly life. The description of the valve and future developments are reported. (auth)

3639 (HPR-35(Vol.I)(Sect.7)) GAMMA THERMOMETER DEVELOPMENT AT HBWR. B. Asphaug (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 19p.

Gamma thermometers were developed and used to measure power in boiling channels at HBWR. The principle of operation, calibration in instrumented fuel assemblies, and analysis of the reactor operation data are described. The potential of gamma thermometers for specific power measurements is discussed. The gamma thermometers have proved their reliability and will now be used for future tests of highly enriched fuel elements in the low enrichment HBWR lattice. (auth)

3640 (HPR-35(Vol.I)(Sect.8)) HBWR TURBINE FLOW METERS ARE BEING DEVELOPED FOR NUCLEAR APPLICATIONS. K. Schenk (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 23p.

The development of turbine flowmeters for installation into instrumented fuel assemblies, their calibration, and results of in-reactor operation are reported. Two flowmeters have operated since February 1963 and have retained their calibrations, eight being the total number employed to date. Design details, improvements, and the application of turbines to fuel assembly behavior analysis are given. (auth)

3641 (HPR-35(Vol.I)(Sect.9)) THE IMPEDANCE VOID METER FOR HBWR. I. Oerbeck (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 48p.

The impedance void meter was designed to measure transient void content to an instrumented fuel assembly at HBWR. The principle of operation is that the electrical impedance between two electrodes immersed in a two-phase fluid will increase if partial replacement of the liquid by vapor occurs. The specification, development, and calibration are described. The use of the void meter in instrumented fuel assemblies and the results obtained are reported. (auth)

3642 (HPR-35(Vol.II)) DEVELOPMENT AND APPLICATIONS OF IN-CORE INSTRUMENTATION AT HBWR. VOLUME II. (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). Aug. 1964. 257p. Dep.(mn).

For abstracts of individual sections see: 3643, 3644, 3645, 3646, 3647, 3648, 3649, and 3650.

3643 (HPR-35(Vol.II)(Sect.10)) THERMOCOUPLES, CABLES AND TUBES FOR IN-CORE INSTRUMENTS AT HBWR. E. Rolstad (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 33p.

Corrosion problems with SS 304 sheath thermocouples in the first instrumented fuel assembly led to their replacement with Inconel. The in-pile calibration of thermocouples, particularly those on instrumented fuel assemblies, is dealt with. (auth)

3644 (HPR-35(Vol.II)(Sect.11)) PRESSURE VESSEL AND IN-PILE PENETRATION SEALS FOR HBWR. R. Engevik (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 43p.

Various pressure vessel penetration seals as well as seals for signal leads from the in-pile instruments at HBWR are described. In most cases mechanical seals provide a successful solution for instrumentation in a heavy-water boiling reactor. (auth)

3645 (HPR-35(Vol.II)(Sect.12)) IN-PILE BURNOUT PROTECTION AT HBWR. H. P. Olson (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 31p.

A thermocouple installed in the fuel pellet canning was used to protect the fourth instrumented fuel assembly at HBWR against fuel surface burnout when the fuel assembly was operated at double the previously limiting specific power. A description of the design and supporting calculations is given. The in-pile performance is reported and the application of this device to safely attain high core power is discussed. (auth)

3646 (HPR-35(Vol.II)(Sect.13)) CENTRAL OXIDE TEMPERATURE MEASUREMENTS AT HBWR. G. Kjaerheim (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 25p.

Tungsten–rhenium thermocouples were installed into two instrumented fuel assemblies at HBWR to determine the maximum central uranium oxide temperature. Details of the thermocouple installation, the experiments made, and the subsequent analysis and comparison with calculated values are discussed. (auth)

3647 (HPR-35(Vol.II)(Sect.14)) FISSION GAS PRESSURE MEASUREMENT. A. Bruun (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 30p.

The fission gas buildup in a fuel element is being studied at HBWR. A transducer was designed and installed in the fourth instrumented fuel assembly. Details of this design, the measuring technique, and the initial experimental results obtained are reported. (auth)

3648 (HPR-35(Vol.II)(Sect.15)) TIME RESPONSES FROM POWER TO VARIOUS TEMPERATURES IN INSTRUMENTED FUEL ASSEMBLIES. J. Hannaford (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 33p.

Measurements were made to determine the time constants of the fuel, burnout detector, and gamma thermometers of two instrumented fuel assemblies. The fuel time constants were determined at various element power levels using can and central oxide thermocouples. Differences between results are considered to be due to the flux depression and temperature profile distortion within a fuel pin. This may necessitate, in some dynamic models, the use of two different time constants for the Doppler reactivity coefficient and heat transfer blocks. (auth)

3649 (HPR-35(Vol.II)(Sect.16)) FUEL FAILURE LOCATION IN NATURAL CIRCULATION BWRs BY LOCAL FLUX DEPRESSION AND BY STEAM SAMPLING FROM SEPARATE FUEL ELEMENTS. J. G. Siverts (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 29p.

The experimental evaluation of a failed-fuel element location system at HBWR is reported. The new irradiation test program includes a large number of fuel elements with a failure risk potential. The application of the technique developed to locate a failure among a number of test fuel elements is described. A description of local flux depression technique to locate a failure of normal second charge fuel assembly is also included. (auth)

3650 (HPR-35(Vol.II)(Sect.17)) POST SHUTDOWN TEMPERATURE MEASUREMENTS ON IFA-4. K. Svanholm (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). 14p.

Temperature measurements of the fourth instrumented fuel assembly using the installed instruments were made 18 hours after HBWR shutdown. Continuous readings were made during removal from the reactor and with subsequent different air cooling conditions. The data and results obtained are reported and it is concluded that forced air cooling is adequate to control decay heat temperature of high-power test fuel assemblies. (auth)

3651 (HW-79977) NUCLEAR CHARACTERISTICS OF SOME COMPACT, WATER-MODERATED PLUTONIUM BURNERS. P. L. Hofmann, G. J. Busselman, and R. H. Holeman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 1964. Contract AT(45-1)-1350. 52p. Dep.; $3.00(cy), 2(mn) OTS.

Nuclear characteristics of thermal or near-thermal plutonium-fueled water-moderated reactors for possible use in propulsion units or package power plants are described. Emphasis is placed on the physics statics and fuel cycle aspects; reactor kinetics are not treated. 44 references. (R.E.U.)

3652 (JAERI-1061) DYNAMIC ANALYSIS OF NATURAL CIRCULATION BOILING WATER REACTOR. Junichi Miida and Nobuhide Suda (Japan Atomic Energy Research Inst., Tokyo). Dec. 1963. 67p. Dep.(mn).

The second report in a series of studies on the dynamic behavior of the natural-circulation boiling water reactors is presented. The simplified versions of the transfer functions derived in the preceding report, JAERI-1044, are obtained. Simplified models are then constructed based on the simplified transfer functions thus derived, in order to readily investigate the dynamic characteristics from the

design parameters. Some of the dynamic characteristics based on the simplified models are given. The dynamic characteristics of the feedback transfer functions and the system stability are also investigated. Comparisons with other studies are briefly given in order to make clear the significance of this study. Studies are with special reference to the JPDR, a 12.5-Mw(e) boiling water reactor. However, models derived here are quite general. (auth)

3653 (NDA-Memo-2014-159) CALCULATIONS ON THE POSSIBILITIES FOR THE FREEZING OF LIQUID URANIUM FOLLOWING HYPOTHESIZED SLOW MELT-DOWN OF APDA REACTOR. H. G. Elrod, Jr. (Nuclear Development Corp. of America, White Plains, N. Y.). Feb. 4, 1957. 15p.

The theory of freezing processes is applied in numerical form to the model of the melt-down process described in NDA-Memo-14-146. Freezing in the reactor core and in the lower axial blanket is treated. It is concluded that freezing will not plug the reactor core, but that plugging of the lower axial blanket is possible on the basis of thermodynamics. (D.L.C.)

3654 (TID-21273) OPTIMAL FEEDBACK CONTROL OF SPATIAL XENON OSCILLATIONS IN A NUCLEAR REACTOR (thesis). Donald Martin Wiberg (California Inst. of Tech., Pasadena). June 26, 1964. Contract [AT(04-3)-41]. 177p. Dep.(mn); $5.00(cy), 3(mn) OTS.

A kinetic model of spatial processes in a power reactor is formulated according to the state space approach. The model is very general, and may include the spatial effects of control rods, temperature, and almost any other deterministic spatial process that can be described by a finite set of partial differential equations. It is noted that any locally unstable process may induce a spatial instability, and that a spatial instability will occur only if a local process is unstable. The concept of a temperature coefficient of reactivity is extended to include spatial variations. A linearization about an operating point is performed, and the resulting linear equations are solved by using a non-interacting modal expansion. Some properties of this type of mode and applications to other physical processes are discussed. It is shown that non-interacting modes exist whenever any other modal expansion exists. An efficient computational procedure for exact numerical solution for the non-interacting modes is given in the case of spatial separability. Simple linear stability estimates for spatial processes are formed by variational techniques that permit evaluation of the effects of spatially varying parameters upon stability. A theorem presents mathematical proof of the linear controllability of any finite number of modes by very few control rods. The circumstances under which an infinite number of modes can be controlled are discussed. Methods of optimal feedback control are used for the analytical design of a spatial control system for minimum integrated quadratic loss, and detailed examples are given. (auth)

3655 (WCAP-6064) YANKEE CORE EVALUATION PROGRAM QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING SEPTEMBER 30, 1964. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Oct. 1964. Contract AT(30-1)-3017. 144p. Dep.; $4.00(cy), 3(mn) OTS.

Hot cell work continued at an accelerated rate during the report period. Essentially all fuel examinations scheduled under the Phase I (14 core I assemblies) and Phase II (one fuel assembly irradiated in Cores I and II) programs have now been completed. The results of the Phase II examinations were gratifying: (a) there was no evidence of corrosion, dimensional changes, cracks, etc.; (b) the corrosion film composition was generally the same as for Phase I fuel rods; and, (c) the cladding of the extended burnup fuel rods exhibited essentially the same microhardness and burst strength as the highest-burnup Phase I samples, indicating that irradiation hardening had reached the saturation level after two cycles in the Yankee core. For comparison with Yankee specimens, post-irradiation examinations were performed on a UO_2 fuel pin irradiated to approximately 52,000 MWD/MTU at a peak heat rating of about 16 Kw/ft. The results showed no straining of the fuel sheath and only marginal evidence of possible swelling, even though current design models predict significant swelling. An evaluation of mass spectrometric and radiochemical data obtained for certain symmetrically located fuel rods indicated that, within the uncertainties of the measurement, no gross burnup asymmetries were present in the Yankee Core I fuel; this is in contrast with both previous and current gamma scan data which indicate a gross gamma activity asymmetry did exist. Further investigations are being conducted in an effort to resolve these apparent anomalies. (auth)

3656 (TID-21280) ARDENNES NUCLEAR POWER PLANT QUARTERLY REPORT NO. 8, APRIL 1–JUNE 30, 1964. (Societe d'Energie Nucleaire Franco-Belge des Ardennes, Chooz-lez-Givet, France). Aug. 7, 1964. Work Performed under United States–Euratom Joint Research and Establishment Program. 34p. (A translation). Dep.(mn); $2.00(cy), 1(mn) OTS.

Design and fabrication of reactor and other power plant components are reported. Civil engineering studies, nuclear studies, and studies of components standard to non-nuclear installations are described. Pictorial evidence of construction progress is included. (R.E.U.)

3657 HIGH TEMPERATURE POWER REACTORS. Atomics, 17: No. 6, 7-18(Nov.-Dec. 1964).

Recent developments in the design and technology of high-temperature power reactors are surveyed, together with developmental work. The main features of all power reactors now in operation, under construction, or in the design stage with steam or exit coolant temperatures over 900°F are tabulated. Aerospace reactors are covered as well as stationary reactors. (D.C.W.)

3658 EXAMINING YANKEE IRRADIATED FUEL ASSEMBLIES. L. Chajson. Atomics, 17: No. 6, 19-24(Nov.-Dec. 1964).

The results of a detailed examination of fuel assemblies discharged from cores I and II of the Yankee reactor are presented. Core performance was evaluated and compared with predictions. The evaluation program is described. (D.C.W.)

3659 THE FUELING OF NUCLEAR POWER COMPLEXES. Gale Young (Oak Ridge National Lab., Tenn.). Nucl. News, 7: No. 11, 23-30(Nov. 1964).

Nuclear power costs and fuel utilization are discussed with consideration of the Oyster Creek station, desalination plants, uranium resources and requirements, breeding, and reactor selection. (D.C.W.)

3660 CONSIDERATIONS FOR A LONGTERM DEVELOPMENT FOR THE USE OF FISSION ENERGY AND THE CONSEQUENCES FOR PRESENTLY DEVELOPED NUCLEAR POWER REACTORS. J. J. Went (Keuring van Electrotechnische Materialen, N. V., Arnhem, Netherlands). Nukleonik, 6: 219-24(Sept. 1964).

The relation between natural uranium ore reserves and the fuel cycle of nuclear power reactors is discussed. In general less than 0.5% of all atoms present in natural uranium can be fissioned in the present "proven" power reactors. In addition to this heat production 0.2 to 0.3% of the atoms can be transformed into plutonium. The known cheap uranium reserves in the world are not sufficient for a large scale power production with these reactors. With breeder reactors the percentage of fissionable atoms is increased by at least an order of magnitude, along with the total percentage of atoms fissioned. The ores financially available for refueling these breeder reactors are increased by a much higher order of magnitude. For starting breeders either ^{235}U or Pu is needed. It is shown that with Pu produced in "proven" power reactors a considerably larger amount of natural uranium is required for a specific breeder power program, than if these breeders should start their first fuel cycle with ^{235}U produced in diffusion plants. Due to the limited reserves of cheap natural uranium known it was concluded that prospecting should be increased to prove much larger rich ore reserves to be present, or that breeders should be started with ^{235}U. If on

a large scale an intermediate group of reactors is needed or desirable, only high conversion reactors, such as several types of heavy water reactors, are considered acceptable. (auth)

3661 POWER REACTOR TECHNOLOGY. Volume 7, Number 4. Walter H. Zinn and J. R. Dietrich (General Nuclear Engineering Corp., Dunedin, Fla.). Fall 1964. $0.70(GPO) (domestic), $0.90 (GPO) (foreign). (One of the Technical Progress Reviews prepared quarterly for the Division of Technical Information, USAEC). 115p.

Reviews are presented of selected recently published reports in the fields of power-reactor research and development, applications, design practice, and operating experience. Separate abstracts were prepared of the reviews. (D.L.C.)

For abstracts of individual sections see: 2477, 2518, 2561, 2734, 3480, 3490, 3591, 3662, 3663, 3664, 3665, and 3666.

3662 MODERATOR-LEVEL CONTROL. Walter Mitchell, III. Power Reactor Technol., 7: 385-400 (1964).

Regulation of moderator height as a means of reactor control is discussed. It is shown that the best reactor type for control in this way is a heavy-water-moderated pressure-tube reactor using a calandria tank with gas-gap insulation around the pressure tubes. Two such reactors are the Plutonium Recycle Test Reactor and the Canadian Nuclear Demonstration Reactor, and their design and operating experience are described. Finally, larger reactor installations are considered, with the CANDU control system as an example. (D.L.C.)

3663 HEAVY-WATER REACTORS. Power Reactor Technol., 7: 401-11(1964).

Design data for several large plants are listed, and the plants are compared with the prototype Carolinas-Virginia Tube Reactor and with other designs. The potential of D_2O reactors as thermal breeder reactors is discussed, and fuel cycle cost data are given (D.L.C.)

3664 PRESSURIZED-WATER REACTORS: CHEMICAL SHIM. Power Reactor Technol., 7: 411-21(1964).

The use of chemical shim for reactivity control in pressurized-water reactors is discussed. A review is presented of the application and behavior of chemical shim. The reactor physics effects of chemical shim are considered. Control requirements and water chemistry are discussed. (D.L.C.)

3665 PRESSURIZED-WATER REACTORS: NATURAL-CIRCULATION STARTUP. Power Reactor Technol., 7: 421-2(1964).

Startup of a power reactor usually requires the use of pumps of capacity larger than that required for normal operation. This disadvantage can be avoided by the following operating technique: the pump is operated for a time sufficient to bring the power level to the safe plant heat-up rate, and then the pump is shut off, while natural circulation maintains an adequate coolant flow as the power level increases. (D.L.C.)

3666 PRESSURIZED-WATER REACTORS: THE LARGE POWER-REACTOR PROGRAM. Power Reactor Technol., 7: 422-31(1964).

A review is given of the Large Power Reactor Program, which has the objective of developing a seed-blanket reactor concept for use in a large power plant (~500 Mw(e)). Reactivity control is obtained by "seed leakage." The pressure vessel is discussed. Core characteristics and fuel utilization characteristics are tabulated for several different fuel cycles. The advantages and limitations of the concept are discussed briefly. (D.L.C.)

3667 XENON-POWER OSCILLATIONS IN PWR-1—ANALYSIS AND OBSERVATIONS. T. R. England (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 220(Nov. 1964).

3668 STABILITY EXTREMA IN NUCLEAR REACTOR SYSTEMS WITH DESIGN UNCERTAINTIES. T. W. Kerlin (Oak Ridge National Lab., Tenn. and Univ. of Tennessee, Knoxville) and J. L. Lucius. Trans. Am. Nucl. Soc., 7: 221-2(Nov. 1964). (ORNL-P-198)

3669 APPLICATION OF ADIABATIC APPROXIMATION TO THE SPACE-DEPENDENT BOILING-WATER REACTOR KINETICS. Hideaki Nishihara (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc., 7: 222-3(Nov. 1964).

3670 BURNUP-INDEPENDENT POWER SHAPING BY FUEL ZONING. K. R. Van Howe and M. H. Merrill (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Trans. Am. Nucl. Soc., 7: 223-4(Nov. 1964).

3671 DEPENDENCE OF POWER SPIKE ON TEMPERATURE AND SCATTERING KERNEL IN BERYLLIUM-REFLECTED FAST REACTORS. R. C. Dahlberg and P. B. Daitch (Rensselaer Polytechnic Inst., Troy, N. Y.). Trans. Am. Nucl. Soc., 7: 229(Nov. 1964).

3672 IMPROVED CALCULATIONS OF SODIUM WORTH IN THE ENRICO FERMI FAST REACTOR. Ben M. Segal (Atomic Power Development Associates, Inc., Detroit). Trans. Am. Nucl. Soc., 7: 240(Nov. 1964).

3673 1000-MW(e) SETTLED-BED FAST REACTOR PHYSICS. A. Aronson and M. M. Levine (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 240-1(Nov. 1964).

3674 MEASUREMENT OF β_{eff} AND POWER CALIBRATION IN FAST REACTORS. R. A. Karam (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 248(Nov. 1964).

3675 STRUCTURAL FEEDBACK EFFECTS IN EBR-I, MARK IV. R. R. Smith, R. O. Haroldsen, and F. D. McGinnis (Argonne National Lab., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 7: 248-9(Nov. 1964).

3676 FAST-REACTOR REACTIVITY COEFFICIENTS; THE EFFECT OF EXCESS REACTIVITY. W. B. Loewenstein (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 249-50(Nov. 1964).

3677 MEASUREMENT OF REACTIVITY AND KINETIC PARAMETERS AT POWER. V. Rajagopal and A. J. Impink, Jr. (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 281(Nov. 1964).

3678 DYNAMIC MEASUREMENTS ON THE SAXTON REACTOR USING RANDOM PERTURBATIONS. V. Rajagopal and G. E. Swen (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 281-2(Nov. 1964).

3679 AN EVALUATION OF A THREE-DIMENSIONAL FLUX SYNTHESIS METHOD AS A NUCLEAR DESIGN TOOL. C. A. Flanagan, F. E. Smith, G. F. Bogar, and C. H. Rutherford (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 289-90(Nov. 1964).

3680 THE BREEDING RATIO OF EBR-1, MARK IV. B. R. Smith, R. O. Haroldsen, R. E. Horne, and R. G. Matlock (Argonne National Lab., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 7: 305-6(Nov. 1964).

3681 CONSIDERATIONS INVOLVED IN FAST-REACTOR-FUEL ELEMENT IRRADIATION TESTING. J. A. DeFlice (Nuclear Technology Corp., White Plains, N. Y.) and W. H. Jens. Trans. Am. Nucl. Soc., 7: 306(Nov. 1964).

3682 TR-SRE: A FAST-FLUX IRRADIATION FACILITY. Anthony V. Campise (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 306-7 (Nov. 1964).

3683 PRELIMINARY DESIGN OF 100-kwe THERMIONIC CONVERSION REACTOR CORE. Frank A. Russo (Martin Co., Baltimore). Trans. Am. Nucl. Soc., 7: 378 (Nov. 1964).

3684 ANALYTICAL STUDY OF POWER MATCHING IN THERMIONIC REACTOR CORES. P. R. Hill and A. J.

Gietzen (General Electric Co., Pleasanton, Calif.). Trans. Am. Nucl. Soc., 7: 378-9(Nov. 1964).

3685 IRRADIATION TESTING IN SUPPORT OF THE PLUTONIUM-RECYCLE DEMONSTRATION EXPERIMENT IN EBWR. W. J. Bailey (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 389(Nov. 1964).

3686 FAILURE EXPERIENCE WITH STAINLESS STEEL CLAD FUEL RODS IN VBWR. T. J. Pashos, R. N. Duncan, H. E. Williamson, W. H. Arlt, C. J. Baroch, and J. P. Hoffmann (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 7: 416(Nov. 1964).

3687 EVALUATION OF HIGHLY IRRADIATED YANKEE FUEL CLADDING. W. R. Smalley (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 416-17(Nov. 1964).

3688 PERFORMANCE OF THIN WALLED STAINLESS STEEL CLAD ROD TYPE FUEL ELEMENTS IN SAXTON. D. R. McClintock, E. Paxson, and H. M. Ferrari (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Nucl. Soc., 7: 417-18(Nov. 1964).

3689 BORON STAINLESS STEEL FUEL ELEMENT CLADDING IN THE INDIAN POINT REACTOR. C. R. Johnson (Babcock and Wilcox Co., Lynchburg, Va.). Trans. Am. Nucl. Soc., 7: 418-19(Nov. 1964).

3690 REACTIVITY EFFECTS OF OPERATING THE BIG ROCK POINT BOILING WATER REACTOR AT PRESSURES OF 800 LB/IN.^{2} TO 1500 LB/IN.^{2} N. H. Barth (General Electric Co., San Jose, Calif.) and T. G. Bassett. Trans. Am. Nucl. Soc., 7: 491-2(Nov. 1964).

3691 OPERATING OF PIQUA NUCLEAR POWER FACILITY FROM CRITICALITY TO FIRST SCHEDULED SHUTDOWN. C. A. Trilling, H. J. Rubenstein, and J. Jacobson (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 492(Nov. 1964).

3692 PNPF FAILED-ELEMENT-LOCATION SYSTEM. Norman K. Rumpf (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 493(Nov. 1964).

3693 PREDICTION OF MID-LIFE POWER DISTRIBUTION IN THE INDIAN POINT REACTOR. D. R. Hostetler (Babcock and Wilcox Co., Lynchburg, Va.). Trans. Am. Nucl. Soc., 7: 493-4(Nov. 1964).

3694 MID-LIFE POWER DISTRIBUTION IN THE INDIAN POINT REACTOR. M. L. Batch (Babcock and Wilcox Co., Lynchburg, Va.), R. M. Ball, R. H. Lewis, and R. H. Freyberg, Jr. Trans. Am. Nucl. Soc., 7: 494(Nov. 1964).

3695 MEASURED AND CALCULATED FISSION DISTRIBUTION IN THE FERMI REACTOR. R. E. Horne and E. M. Page (Atomic Power Development Associates, Inc.). Trans. Am. Nucl. Soc., 7: 494-5(Nov. 1964).

3696 PROGRAM FOR THE PREVENTION OF CARBURIZATION OF STEEL CORE COMPONENTS AT THE HNPF. A. I. Hanse, H. J. Rubinstein, and E. N. Pearson (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 495-6(Nov. 1964).

3697 EFFECTIVE HOT CHANNEL FACTORS FOR "FLAT" POWER REACTORS. F. D. Judge and L. S. Bohl (Knolls Atomic Power Lab., Schenectady, N. Y.). Trans. Am. Nucl. Soc., 7: 497(Nov. 1964).

3698 CHEMICAL SHIM CONTROL OPERATING EXPERIENCE IN THE SAXTON REACTOR. S. Bartnoff (Westinghouse Electric Corp., Pittsburgh), J. Weisman, and W. H. Layman. Trans. Am. Nucl. Soc., 7: 502-3(Nov. 1964).

3699 THE ORGEL PROJECT. J. C. Leny (European Atomic Energy Community, Brussels). Trans. Am. Nucl. Soc., 7: 519-20(Nov. 1964).

3700 RECENT OPTIMIZATION METHODS FOR ORGEL. W. Boettcher, F. Lafontaine, and P. Tauch (Euratom, Ispra, Italy). Trans. Am. Nucl. Soc., 7: 520-1(Nov. 1964).

3701 ORGEL TECHNICAL LOOP AND RELATED WORK. S. Finzi, J. P. Rougeau, and G. Volta (Euratom, Ispra, Italy). Trans. Am. Nucl. Soc., 7: 522(Nov. 1964).

3702 THE EFFECT OF EARLY INTRODUCTION OF BREEDER REACTORS ON URANIUM RESOURCE CONSERVATION. W. I. Neef (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 529-30(Nov. 1964).

3703 EVALUATION OF BREEDERS FROM A CONSERVATION STANDPOINT. Paul F. Gast (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 530-1(Nov. 1964).

3704 THE PRODUCTION OF INDUSTRIAL CHEMICALS BY CHEMICONUCLEAR PROCESSES. Meyer Steinberg (Brookhaven National Lab., Upton, N. Y.). Trans. Am. Nucl. Soc., 7: 531-2(Nov. 1964).

3705 ISSLEDOVANIYA PO PRIMENENIYU ORGANICHESKIKH TEPLONLSIPELEI-ZAMEDLITELEI V ENERGETICHLOKIKH REAKTORAKH. (Research on the Use of Organic Coolants and Moderators in Power Reactors). Yu. N. Aleksenko, ed. Moscow, Atomizdat, 1964. 245p.

Research in the USSR on organic liquids for power reactors is summarized, including research on thermal properties, radiation chemistry, neutron physics, and interactions with materials. The deficiencies of organic coolants are emphasized, together with efforts to overcome the deficiencies. (D.C.W.)

3706 COSTI E PROSPETTIVE ELETTRONUCLEARI. (Costs and Prospects of Nuclear Power). Tommaso Zerbi. Milan, Dott. A. Giuffre, 1962. 119p.

A textbook designed for economic and commercial students at the Universita Cattolica del Sacro Cuore discusses the problems of economic comparison and possible consequences in the industrial production of nuclear power. The innovations in organizational structure, financing, and public control, which modify the business concepts in a fundamental section of the productive system, are considered. The nuclear power plants in operation or under construction are discussed with consideration of the types of reactors used. The effect of public control on the net cost is discussed. Cost comparisons between nuclear and conventional power plants are made. A breakdown is given of the costs for enriched-uranium water-moderated reactors. The present and future competitivity of nuclear energy in the Italian electrical system is discussed. (J.S.R.)

3707 RECENT DEVELOPMENTS IN DESIGN OR PRESSURIZED WATER REACTORS. Charles Gerard (Ateliers de Constructions Electriques, Charleroi, Belg.). p.31-5 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In French)

Factors in the evolution of reactor design are discussed, including improvement of the power distribution in the core, improvement of the thermodynamic characteristics, increase in the burnup, and fuel charging and cycling programs. (D.C.W.)

3708 CHARACTERISTICS AND STATUS OF DEVELOPMENT OF THE ARDENNES NUCLEAR CENTER. Ch. Gerard and P. Klees (Ateliers de Constructions Electriques, Charleroi, Belg.). p.159-68 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In French)

The 242-Mw(e) Sena power station under construction near Givet is described, and the status of the installation is indicated. The notable features of the pressurized-water reactor are discussed, together with particularly complex fabrication procedures. (D.C.W.)

3709 CORE FOR A SUPERCRITICAL PRESSURE POWER REACTOR. Harold Harty, James J. Regimbal, Kadzuhisa G. Toyoda, and Richard D. Widrig (to U. S. Atomic Energy Commission). U. S. Patent 3,156,625. Nov. 10, 1964.

A core for a supercritical-pressure power reactor is described, composed of a number of fuel elements containing pressure tubes for coolant and a number of control

grids, each of which encompasses and interpenetrates a number of the fuel elements, thereby protecting the reactor against rupture of a pressure tube. (AEC)

Production Reactors

3710 (HW-80117) HYDRIDE EMBRITTLEMENT OF N-FUEL INNER SUPPORTS. R. R. Studer (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 16, 1963. Contract AT(45-1)-1350. 16p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Discovery of the existence of hydride embrittlement at an early date in the history of N-fuels assembly prevented completion of a major portion of the first load of fuels with defective inner supports. Cooperation of the groups assigned to investigate the different aspects of inner support quality led to an early definition of the nature and extent of inner support cracking and the to development of an operable process for restoring ductility to supports embrittled during the autoclave cycle. As a result, manufacturing was able to resume final assembly operations two weeks after discovery of the problem with no serieus effect on production schedules. The solution heat treatment and quench of autoclaved fuels is an added operation and therefore an added cost, but it permits continued production of satisfactory fuels while potentially more desirable but less easily definable processes are being developed. (auth)

3711 SAVANNAH RIVER PLANT EXPERIENCE WITH TYPE-304 STAINLESS STEEL IN HEAVY-WATER COOLED REACTORS. S. P. Rideout, W. C. Rion, Jr., and J. W. Wade (E. I. du Pont de Nemours & Co., Aiken, S. C.). Trans. Am. Nucl. Soc., 7: 419(Nov. 1964).

Propulsion and Space

Refer also to abstract 2575.

3712 (64SD647) STUDY ON APPLICATION OF NUCLEAR ELECTRICAL POWER TO MANNED ORBITING SPACE STATIONS. PHASE II. STATION/POWERPLANT INTEGRATION STUDIES. Topical Report No. 2. B. J. Tharpe (General Electric Co. Missile and Space Div., Valley Forge Space Technology Center, King of Prussia, Penna.). June 5, 1964. Contract NAS-3-4160. 282p.

The application of SNAP-8 to a specific space station is considered. Methods of increasing power-system reliability, station/power-system interactions, shielding, modifications of the SNAP-8 Hg Rankine cycle, and power system design are discussed. (R.E.U.)

3713 (64SD892) RESEARCH ON SPACECRAFT AND POWERPLANT INTEGRATION PROBLEMS. J. W. Larson (General Electric Co. Missile and Space Div., Valley Forge Space Technology Center, King of Prussia, Penna.). [1964]. Contract NAS 3-2533. 196p. (NASA-CR-54159)

Spacecraft and power generating system designs were investigated to determine the component and subsystem requirements and further research and development areas necessary to provide a capability for unmanned scientific exploration of the solar system. Power generation systems included both nuclear Rankine cycle and nuclear in-core thermionic power plants. The Rankine cycle system was based on a power plant technology level consistent with the original SNAP-50 design objectives as of contract initiation. The design conditions for both Rankine cycle and thermionic systems were specified by NASA-Lewis. Mission requirements were established that are marginal for, or beyond the capability of, chemical and solid core nuclear rocket propelled space vehicles. These missions included close approach solar probes, high inclination out-of-ecliptic probes, and orbiters for Mercury and the outer planets (beyond Mars). Sample spacecraft and power plant designs were prepared. However, it is somewhat difficult to make direct comparisons between different power plant types because many of the key components are not sufficiently advanced in development. Rigorous system optimization was not conducted but key problem areas were identified that would likely escape a purely parametric analysis. It is not believed that detailed component specifications can be established at this time. One particular reason is that an item such as required power plant specific weight is related to trip time and the applicable tradeoff cannot yet be established. General guide lines or ground rules that were identified are divided into two categories: those arising from the mission analysis affecting the overall spacecraft and power system; and those pertaining to the design and proper functioning of particular components and subsystems. (auth)

3714 (ASTRA-G-41.3) ELECTRIC PROPULSION POSSIBILITIES USING STEAM SPACE POWER. (Astra, Inc., Raleigh, N. C.). Apr. 2, 1964. Revised Sept. 10, 1964. 11p.

Some advantages of systems of electric thrusters and advanced steam space power plants for possible use in electric rockets are discussed. Matching of intrinsic characteristics show favorable advantages; lower weights, higher efficiencies, and greater lifetimes with the removal of separate cooling loops and inclusion of regenerative heating as input to the power system are considered. (R.E.U.)

3715 (EGG-1183-1071) SNAPTRAN 2/10A-3 PHOTOGRAPHY. (Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.). July 30, 1964. Contract [AT(29-1)-1183]. 36p. Dep.; $2.00(cy), 1(mn) OTS.

The photographic and optical instrumentation for the SNAPTRAN-3 (2/10A) destruct test is described. Camera and film selection are discussed. Special problems created by the SNAP destruction time and by radiation hazards are described, and their solution is discussed. (R.E.U.)

3716 (FZK-154) A STUDY OF SOME REACTOR SHIELDING PROBLEMS FOR SPACECRAFT APPLICATIONS. E. E. Jones and M. B. Wells (General Dynamics/Fort Worth. Div. of General Dynamics Corp., Fort Worth, Tex.). Oct. 29, 1962. Contract NAS8-1573. 117p.

Machine programs for computing the single-scattered neutron and gamma fluxes from radiators of reactor-powered spacecraft are described and some calculated results for typical unshielded SNAP-8-powered spacecraft are presented. Calculations to investigate the effect of uniform expansion of a direct-beam shield on the transmitted neutron dose rate in the absence of a scattering atmosphere are reported. The results of some Monte Carlo calculations of the effects of shield-splitting on neutron transmission through direct-beam shields in the absence of a scattering atmosphere are discussed. (auth)

3717 (FZK-156) A MONTE CARLO PROCEDURE FOR RADIATION TRANSPORT AND HEATING STUDIES. M. B. Wells and C. F. Malone (General Dynamics/Fort Worth. Div. of General Dynamics Corp., Fort Worth, Tex.). Oct. 29, 1962. Contract NAS8-1573. 171p.

A Monte Carlo procedure for the IBM 7090 digital computer was developed to perform calculations of the radiation heating in propellant tanks and the radiation environment about a nuclear rocket stage. The procedure is made up of FORTRAN codes to compute region volumes and to generate primary source particle parameters, neutron and gamma-ray histories, and secondary gamma-ray source parameters. The codes will also analyze the history data so that the particular quantities desired as answers to a given problem may be determined. The methods used to describe the geometries, materials, nuclear properties, and type of sources and the method in which the exponential transformation is used are discussed. The application of Monte Carlo techniques to the scattering routines used in the tracing of neutron and gamma-ray life histories is described. Instructions for preparation of the program input data and a description of the output obtained from the running of each of the individual codes making up the Monte Carlo procedure are presented. (auth)

3718 (FZK-184-1) NERVA COMPONENTS IRRADIATION PROGRAM. VOLUME 1. GTR TEST 11. J. W. Evans, W. D. McMillan, E. E. Palmer, and A. B. Spears (General Dynamics/Fort Worth. Div. of General Dynamics

Corp., Fort Worth, Tex.). May 15, 1964. Contract AF29 (601)-6213. 134p.

An experiment was performed utilizing the NARF Ground Test Reactor to determine the effects of combined reactor radiation and cryogenic (liquid nitrogen) temperatures on linear motion displacement transducers (LMDT's), WANL strain gages, developmental strain gages, dome end support ring sections, and cork board insulation. These components were of the type proposed for the NERVA engine. In general, the experimental design encompassed three prime objectives: (1) to determine radiation rate (transient) effects on the electrical characteristics of the test items, (2) to determine the effects of total radiation exposure on these characteristics, and (3) to determine abilities to recover these electrical characteristics after removal from the radiation field. To achieve these objectives, the experiment was performed in four phases: (1) measurements prior to irradiation; (2) power level steps in the beginning of the test, with data taken at 0.01 Mw, 0.1 Mw, 1.0 Mw, and 3 Mw; (3) an extended irradiation at 3 Mw with data taken periodically during this interval; and (4) measurements after irradiation. The LMDT's, WANL strain gages, and developmental strain gages were maintained at −320°F during irradiation by a liquid nitrogen (LN_2) environment. The dome end support ring elements were bathed in frigid nitrogen gas, and were kept at a temperature of −200°F to −300°F during the experiment. Pre- and post-irradiation data were taken at cryogenic and at room temperature. (D.L.C.)

3719 (LA-DC-6530) NEUTRONIC BEHAVIOR OF COUPLED ROVER CORES. R. L. Seale and C. G. Chezem (Los Alamos Scientific Lab., N. Mex.). [1964]. Contract W-7405-eng-36. 5p. (CONF-654-15). Dep.(mn); $1.00 (cy), 1(mn) OTS.

From American Nuclear Society Meeting, San Francisco, Nov.-Dec. 1964.

The neutronic behavior of an array of clustered reactor cores (Kiwi B-4 type) was studied. The interaction is described by a coupling coefficient and lag time characteristic of the interchange of neutrons between the cores. Expressions are derived for the transfer function of each core in an array due to rod oscillation in one core. (R.E.U.)

3720 (LA-DC-6576) INTEGRAL REACTOR TESTS IN PROJECT ROVER. Keith Boyer (Los Alamos Scientific Lab., N. Mex.). Oct. 9, 1964. Contract W-7405-eng-36. 7p. (CONF-797-2). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Society of Mechanical Engineers, Albuquerque, N. Mex., Oct. 1964.

Integral tests, which are conducted at reactor design power, for the Rover systems are discussed. Modifications to component design and testing procedures from these tests are described. (R.E.U.)

3721 (LA-DC-6652) ANALOG SIMULATION OF KIWI REACTOR CONTROLS. J. E. Perry, Jr. (Los Alamos Scientific Lab., N. Mex.). [1964]. Contract W-7405-eng-36. 21p. (CONF-797-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From American Society of Mechanical Engineers, Albuquerque, N. Mex., Oct. 1964.

The use of an analog computer in the mathematical design of the control systems for the Kiwi reactors is discussed. The basic variables to be controlled are the flow of liquid hydrogen (coolant and propellant for rocket engine) and the temperatures to which the hydrogen is heated by the reactor. Analytical aspects of the control system development are discussed. 26 references. (R.E.U.)

3722 (NAA-SR-9647) SNAP-10A RADIATION SHIELD ANALYSIS. J. A. Belcher, W. A. Flynn, and R. J. Thomson (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 15, 1964. Contract AT(11-1)-Gen-8. 32p. Dep.; $2.00(cy), 1(mn) OTS.

The final analysis of the SNAP 10A flight system radiation shield has been completed; the results are summarized. Preliminary analysis of the shield design indicated that the direct penetration dose at the 5-ft diameter reference dose plane 17.5 ft from the lower face of the reactor core would meet the flight design objectives of 10^{12} nvt and 10^7 R for one year of operation. Subsequent analysis indicated that due to scattering effects from the edges of control drums, the NaK piping around the shield, and the thermoelectric converter system, some regions of the dose plane would be exposed to doses beyond the specified limits. However, through judicious placement and hardening of radiation sensitive instruments and the somewhat localized nature of the scattering effects, an increase in shield size for the SNAP 10A flight test was not warranted. This analysis employed conventional ray-tracing theory throughout. Technique, theory, computer codes, parameters, etc. are discussed. In addition to computing radiation levels behind the shield, internal heat generation was determined. The results show that for the particular combination of tolerance (10^7 R), separation distance (17.5 ft), and reactor power (34 kw) that specific gamma shielding was not required. LiH was selected as the fast neutron shield material since for a given neutron attenuation it provides the lightest weight shield. (auth)

3723 (NAA-SR-9779) SNAP FUEL REENTRY BURNUP EXPERIMENT IN A HYPERTHERMAL WIND TUNNEL. J. W. Baughn (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Oct. 15, 1964. Contract AT(11-1)-Gen-8. 77p. Dep.; $3.00(cy), 2(mn) OTS.

Specimens of SNAP fuel material were tested in a simulated re-entry environment; behavior in this environment was observed and is described in the report. This behavior was compared to and agreed with computations using a simple thermal approximation to the fuel material. The behavior was also extrapolated directly to that of an orbital re-entry (with release of the reactor fuel rods from the reactor vessel at an altitude of approximately 240,000 ft). (auth)

3724 (NAA-SR-Memo-10165) ONE-HUNDRED-FOOT DROP TESTS ON SIMULATED SNAP-10A REACTOR VESSELS. A. Dailey (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). July 9, 1964. Contract AT-11-1-GEN-8. 20p. Dep.(mn); $1.00 (cy), 1(mn) OTS.

The objective of the test was to determine the structural disassembly characteristics of thin-wall, grooved, and ungrooved cylinders upon impact on concrete from 100 feet. On May 20, 1964, 100-foot drop tests were conducted on reactor vessel test specimens to determine G levels experienced by the units at contact but more importantly to ascertain the characteristic and extent of structural damage sustained by the units. The Aerospace Safety Group arranged for and managed the general test program; accelerometer instrumentation and data reduction were requested of and provided by the Environmental Test Laboratory through TWR funding. Three specimens from a group of six were utilized for these tests. The remaining three were used by the Aerospace Safety Group for other phases of reactor vessel testing. (auth)

3725 (NAA-SR-Memo-10169) SNAP-10A NaK LOADING CART ACCEPTANCE TEST. N. D. Huse and T. M. Funakura (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). July 10, 1964. Contract AT-11-1-GEN-8. 39p. Dep.(mn); $2.00(cy), 1(mn) OTS.

The SNAP 10A NaK Loading Cart was Acceptance tested from February 17, 1964 to April 9, 1964, after it was modified during the period of October 1963 to February 1964. A total of 350 pounds of NaK was cleaned by cold trapping to a quality acceptable for the SNAP Unit loading and verified by the performance of a total of eleven NaK Plugging Tests. Further modifications to the NaK Loading Cart were made during the Acceptance Test. A short discussion of these modifications is included. (auth)

3726 (NUS-179) ENVIRONMENTAL SAFETY ASPECTS OF NUCLEAR ROCKET FLIGHT OPERATIONS. Annual Progress Report. (Nuclear Utility Services, Inc., Washington, D. C.). June 1964. Contract SNPC-6. 250p. Dep.; $6.00(cy), 5(mn) OTS.

The earlier analysis (NUS-122) is further refined by incorporation of recent data from programs within and without the ROVER program and by programming for computa-

tion. The computer program includes the capacity for source, environmental, and biological transfer of fission products. An attempt was made to summarize all the studies which would be useful for the safety aspects of NERVA/RIFT. Studies were made of the problems involved in the return of core fragments in event of failure of a nuclear stage, and the various doses are considered. Finally, a script was prepared for a proposed motion picture describing the ROVER safety program and its applicability to the NERVA/RIFT project. (D.L.C.)

3727 (ORNL-TM-921) POSTIRRADIATION EXAMINATION OF MARITIME-ORR LOOP EXPERIMENTS 5, 7, AND 8. M. F. Osborne and E. L. Long, Jr. (Oak Ridge National Lab., Tenn.). Oct. 1964. Contract W-7405-eng-26. 62p. Dep.(mn); $3.00(cy), 2(mn) OTS.

Experiments designed to demonstrate the suitability of nonsintered UO_2 as fuel for a future core of the NS Savannah reactor were operated in the ORR Pressurized Water Loop. Each experiment was a cluster of three 19-in. long fuel rods, and all rods were made of 0.5-in. OD by 0.035-in. wall type-304 stainless steel. The rods were loaded with low-enrichment UO_2 powder, and were either vibratory compacted or cold swaged to size. During irradiation the linear heat rating of individual rods varied from 26,000 to 70,000 Btu/hr/ft. Fuel burnup ranged from 4000 to 8000 Mwd/Mt U. After irradiation each fuel rod was examined for dimensional stability, fission gas release, and structural changes in the fuel and cladding. Appreciable fuel rod bowing had occurred where two fuel rod-to-ferrule brazed joints had failed. Examination of the electroless-nickel brazed joints showed that failures should be expected where the parts are more than 1 mil apart when brazed. There were no significant changes in the diameters of the vibratory compacted rods, but the diameter of the cold swaged rod had increased as much as 8 mils. Fission gas release varied widely with fuel temperature and gross changes in microstructure. Less than 5% of the krypton was released from the fuel in rods with no central void, while more than 10% of the krypton was released in rods irradiated at temperatures high enough to form central voids. There were no indications that the UO_2 had melted in any area, nor were there any adverse effects on the cladding (i.e. no indication of potential failure). (auth)

3728 (PWA-2319) PARAMETRIC STUDY OF HIGH-POWER IN-PILE NUCLEAR THERMIONIC SPACE POWER-PLANTS. A. U. Buatti and J. V. Clausi (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). Mar. 1, 1964. Contract NASw-763. 88p.

An analytical system study of in-pile nuclear thermionic space power plants was conducted for a power range of 2.5 to 10 Mw(e). This study consisted of two parts: (1) a parametric study, and (2) an off-design study of a reference design power plant to be covered in a later report. The parametric portion of this study was performed to answer two questions. These are: (1) what are the conditions that define an optimum (i.e., practical, minimum weight) system, and (2) can the same thermionic fuel element be used in different size reactors to build power plants for a wide range of mission power requirements. The work done to answer the first question, the system optimization, considered maximum cathode temperatures from 2900 to 3800°F for a power range from 2.5 to 10 Mw(e), and using lithium as the fluid in both the primary and secondary loops. This study was repeated at a cathode temperature of 3200°F using NaK as the fluid in both loops. In all cases the study was repeated for both Nb–1Zr and beryllium as the radiator fin and meteoroid barrier material. The work done to answer the second question, the standard fuel element study, considered the same range of cathode temperatures, power levels, fluids, and barrier materials as the system optimization. However, a fixed reactor fuel element configuration and a fixed average fuel composition were used for this study. (auth)

3729 (PWA-2342) SPACE POWERPLANT STARTUP AND TRANSIENT OPERATION SIMULATION WITH DIRECT-CONDENSING RADIATOR SYSTEM. J. R. Hooper and H. R. Kunz (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). May 6, 1964. Contract NAS 3-2335. 54p. (NASA-CR-54179)

Experiments were conducted to investigate the feasibility of using a hard-fill method of starting a direct-condensing nuclear Rankine-cycle power plant in space. In a hard-fill start, only the amount of working fluid required at steady state is injected into the evacuated Rankine-cycle power loop, and no accumulator is provided. The investigations were performed with a power plant simulator using water and designed to simulate many of the fluid flow and heat transfer characteristics of such a power plant. Two problems appeared to arise because of this starting technique: (1) a small error in the amount of fluid injected may cause a significant change in the steady-state operating conditions of the power plant, and (2) the required net-positive-suction head at the power-loop pump inlet probably cannot be maintained during the starting period unless additional control measures are added to the starting procedure. Three means of maintaining the required NPSH were investigated on the simulator. The most practical seemed to be to overfill the system during the starting period from a fill tank and a small pressure-regulating accumulator. The excess fluid is returned to the accumulator as the system approaches steady state. Exploratory tests on a starting method in which the Rankine-cycle loop is filled with liquid prior to starting indicated that special care is required in providing means for the removal of excess fluid from the power loop, and in regulating the rate of heat addition and the flow rates during the starting period. (auth)

3730 (SC-RR-64-515) RE-ENTRY FLIGHT DEMONSTRATION NUMBER ONE (RFD-1)— PREFLIGHT DISASSEMBLY OF THE SIMULATED SNAP-10A REACTOR. R. D. Klett, T. M. Hysinger, and M. M. Robertson (Sandia Corp., Albuquerque, N. Mex.). Sept. 1964. Contract AT(29-1)-789. 149p.

The report describes the SNAP-10A Simulated Test Reactor, the test philosophy of Re-entry Flight Demonstration Number One, the analytical analysis of reactor disassembly, and the results of the flight test. The preflight analytical analysis included wind-tunnel tests, computer studies of the trajectory and of stagnation-point heating to determine local heating rates expected during the flight, and a computer analysis of reactor burnup. The computer studies were repeated after the flight test, using the actual atmospheric density and the observed trajectory. The results of the analytical studies are compared with the actual disassembly, as determined by optical, spectrographic, and telemetered data from the flight. Since there was good correlation between the analytical and the flight-test data, the disassembly of a simulated test reactor was predicted, assuming the flight unit had re-entered on an orbital-decay trajectory at a zero-degree angle of attack. (auth)

3731 THE FIRST GERMAN ATOMIC SHIP. Belgicatom, Assoc. Belge Develop. Pacifique Energie At., Bull. Inform. No. 50, 27(June 1964).

A cross section is given of the service area for the storage of spent fuel elements, the reactor area, the machine room with turbines, condensers, and drives, and the auxillary boiler room for emergency propulsion. (J.S.R.)

3732 PROBLEMS IN THE FABRICATION OF INSTALLATIONS FOR NUCLEAR SHIP PROPULSION. M. C. van Veen. Belgicatom, Assoc. Belge Develop. Pacifique Energie At., Bull. Inform. No. 50, 45-50(June 1964). (In Dutch)

Some factors in the fabrication of reactor vessels and core construction were discussed. The effects of the choice of material on the fabrication procedures, economical welding methods, and the use of stainless steel in core supports were also considered. (J.S.R.)

3733 ADVANCED PRESSURIZED WATER REACTOR FOR A NUCLEAR ENERGY RESEARCH SHIP. H. Koenig (Deutsche Babcock and Wilcox-Dampfkessel-Werke, Oberhausen, Ger.). Belgicatom, Assoc. Belge Develop. Pacifique Energie At., Bull. Inform. No. 50, 59-66(June 1964). (In German)

The advanced pressurized water reactor, developed es-

pecially for ship propulsion, is cooled and moderated with light water and develops a thermal output of 38 Mw. The design of the reactor, reactor pressure vessel, auxiliary installations, and electrical and electronic equipment are described. (J.S.R.)

3734 NUCLEAR ENERGY RESEARCH SHIP OF THE GESELLSCHAFT FÜR KERNENERGIEVERWERTUNG IN SCHIFFBAU UND SCHIFFAHRT MBH., HAMBURG. W. Wiebe. Belgicatom, Assoc. Belge Develop. Pacifique Energie At., Bull. Inform. No. 50, 67-70(June 1964). (In German)

The design and characteristics of the nuclear-propelled ore transport vessel are described. The conventional part of the ship, precautions to assure safety of reactor and ship, engine room, auxiliary drive, electrical equipment, and experimental devices are discussed. Plans for model studies are indicated. (J.S.R.)

3735 EVALUATION OF A THERMIONIC DIODE FOR SPACE POWER USING A LIQUID-METAL ELECTRON COLLECTOR. A. J. Ulrich (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 377-8(Nov. 1964).

3736 REACTIVITY VARIATION DURING STARTUP IN NUCLEAR ROCKETS. Winston W. Little, Jr., Edward A. Mason, and K. F. Hansen (Massachusetts Inst. of Tech., Cambridge). Trans. Am. Nucl. Soc., 7: 380-1(Nov. 1964).

3737 NEUTRONIC COUPLING OF CLUSTERED NUCLEAR ENGINES. Jan S. Woyski and R. W. Langley (Douglas Aircraft Co., Inc., Santa Monica, Calif.). Trans. Am. Nucl. Soc., 7: 381-2(Nov. 1964).

3738 SNAPTRAN 2/10A-3 DESTRUCTIVE TEST RESULTS. W. E. Kessler, W. J. Neal, and G. F. Brockett (Phillips Petroleum Co., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 7: 383(Nov. 1964).

3739 USE OF ENERGY DENSITY MEASUREMENTS TO CALIBRATE NUCLEAR DETECTORS DURING THE SNAPTRAN-3 DESTRUCTIVE EXPERIMENTS. D. F. Paddleford, A. Weitzberg, J. O. Zane, and L. I. Moss (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 384(Nov. 1964).

3740 ANALYTICAL DESCRIPTION OF SUPER-PROMPT CRITICAL TRANSIENTS IN URANIUM–ZIRCONIUM HYDRIDE FUELED REACTORS. Laurence I. Moss and Kenneth E. Buttrey (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 384-5(Nov. 1964).

3741 SNAP 8 GROUND PROTOTYPE NUCLEAR TEST FACILITY. John F. Stolz and H. A. Ross-Clunis (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 386(Nov. 1964).

3742 FISSION FRAGMENT ENERGY SPECTRUM EFFECTS IN FISSION-ELECTRIC CELL EFFICIENCY CALCULATIONS. G. H. Miley (Univ. of Illinois, Urbana). Trans. Am. Nucl. Soc., 7: 386-7(Nov. 1964).

3743 A REPAIRABLE NUCLEAR SPACE POWER PLANT. M. J. Janicke and J. C. Carter (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 533-4(Nov. 1964).

3744 KERNENERGIEANTRIEBE FÜR HANDELSSCHIFFE. 3. JAHRBUCH DER STUDIENGESELLSCHAFT ZUR FÖRDERUNG DER KERNENERGIEVERWERTUNG IN SCHIFFBAU UND SCHIFFAHRT e.V. 1964. (Nuclear Energy Propulsion for Merchant Vessels. 3rd Yearbook of the Research Society for Development of Nuclear Energy Utilization in Shipbuilding and Ship Transport, 1964). E. Bagge and J. Scholvin, eds. Munich, Verlag Karl Thiemig KG, 1964. 225p. 32,-DM.

Thirty-one papers presented at the Third International Reactor Session of the Research Society for Promotion of Nuclear Energy Utilization in Shipbuilding and Navigation, in Hamburg, May 27 to 30, 1964, are included in this third yearbook. Separate abstracts were prepared for each paper. (M.C.G.)

For abstracts of individual papers see: 2564, 2565, 2760, 3707, 3708, 3745, 3746, 3747, 3748, 3749, 3750, 3751, 3752, 3753, 3754, 3755, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3764, 3765, 3766, 3767, 3768, 3769, and 3770.

3745 NEW DEVELOPMENTS IN PRESSURIZED WATER REACTORS FOR SHIP PROPULSION. THE STATUS IN ITALY. M. Vallauri (FIAT, Turin). p.1-4 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

Various water reactor types for ship propulsion were compared in the framework of the Euratom-FIAT-Ansaldo program. The current status and outlook for further development of pressurized-water reactors for ship propulsion are reviewed. Development of the pressurized-water reactor in the Euratom-FIAT-Ansaldo program is described. (M.C.G.)

3746 THE INTERIM DESIGN FOR A DUTCH SHIP REACTOR. M. Bogaardt, M. Muysken, and W. Hofman (Reactor Centrum, The Hague). p.5-13 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964.

The NEREUS reactor system was designed to serve as a nuclear propulsion system for a 65,000 ton dwt, 22,000 shp oil tanker. This resulted in a nuclear steam supply system design with a reactor power of 67 Mw(t), delivering moderately superheated steam of 40 kg/cm^2 and 280°C at the superheater outlet. The reactor core is designed to operate 1200 days at its maximum continuous power rating, which was evaluated to be equal to 4 calendar years of operational service of the ship. Reactivity control is performed both by 12 y-type control rods, containing boron carbide as absorber, and the burnable poison, also in the form of boron, in the fuel. A chemical shut-down system, by means of which a boron solution can be introduced into the primary system, is provided as an additional, completely independent shut-down mechanism. The primary coolant system consists of 2 closed cooling circuits connected in parallel to a single reactor pressure vessel containing the core. Each of the circuits consists of a vertical U-tube bundle steam generator with an integral superheater and canned motor pump, and the associated piping and valves. The core contains 42 zirconium-alloy-clad fuel elements. Diagrams are presented. (M.C.G.)

3747 RESEARCH AND DEVELOPMENT WORK ASSOCIATED WITH THE VULCAIN REACTOR. R. P. Kinsey (Atomic Energy Authority, Risley, Lancs, Eng.) and P. E. Maldague. p.14-19 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964.

The joint Anglo-Belgian research program on the Vulcain reactor is described. Core performance and design studies, engineering development, coolant flow studies, fuel element endurance tests, development of shut-off mechanisms, design of an internal pressurizer, system for primary coolant purification, the Power Demonstration Experiment, and fuel element development are discussed. The economics of nuclear ships, the design objectives of the Vulcain reactor, and pressurization are covered in the appendices. (M.C.G.)

3748 RESULTS OF A STUDY ON A HORIZONTAL PRESSURIZED WATER REACTOR. E. Gnam. p.20-5 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

A pressurized water reactor type was used for a horizontal design concept study. The design is described and its advantages considered. Diagrams are included. (M.C.G.)

3749 REVIEW OF CNSG MARINE REACTOR PROGRAM AND RECENT ADVANCES. R. T. Schomer and G. A. Sawyer (Babcock and Wilcox Co., Lynchburg, Va.). p.26-30 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964.

Based on the design and fabrication experience of the NS Savannah, an improved reactor concept, CNSG III, was developed. This flexible water reactor design is adaptable to power levels of from 10,000 to 80,000 shaft horsepower. Recent economic studies showed the CNSG III to be superior to conventional power in a high-speed, transoceanic,

express service application. The design review encompasses the following fundamental areas of economics: reduction of reactor plant capital costs, improvement of plant efficiency and economy, and reduction of fuel cycle costs. (auth)

3750 THE NORWEGIAN-SWEDISH NUCLEAR SHIP PROJECT. Gunnar Randers (Institutt for Atomenergi, Kjeller, Norway). p.36-8 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964.

Design studies are being made in a joint Norwegian-Swedish program on a nuclear ship. An ore carrier was selected as the ship for the study and a pressurized water reactor was chosen as the means of propulsion. The arrangement, heat balance, and economics are discussed. (M.C.G.)

3751 EXPERIMENTAL INVESTIGATION OF THE DYNAMIC PROCESSES IN MARINE BOILING WATER REACTORS. A. Kirchenmayer and G. Kuerz (AEG-Kernenergieanlagen, Frankfurt am Main). p.39-42 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

The dynamic behavior of a reactor with steam formation in the core, which is produced for ship motion, can be calculated on the basis of an analytical model, whose effectiveness was previously shown. In addition some beginning quantities must be known. The most important beginning quantity is the dependence of steam advance velocity on vertical acceleration, which was not previously sufficiently known. In order to experimentally determine this relation a rotatory test chamber was built, which operates on the sling equipment at Geesthacht. Therefore measurements were carried out on a two-phase flow, for which the vertical acceleration was changed in the necessary way. The experimental data obtained, in combination with the analytical model, made possible the complete calculation of the transient behavior of the entire reactor installation. (tr-auth)

3752 NS SAVANNAH CONTAINMENT TESTS. R. T. Schomer and J. H. Taylor (Babcock and Wilcox Co., Lynchburg, Va.). p.43-5 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964.

The containment vessel leak rate determines the release of radioactivity from a maximum credible accident. Leak rate tests in the past were limited to pressures lower than those encountered in a maximum credible accident. Extrapolation was necessary to predict the release of radioactivity. Improved procedures for NS Savannah tests avoided the errors of extrapolation by increasing the test pressure to 60 psig. Leak rates were determined by both absolute and reference methods. Close correlations of the results of these two methods were obtained. The tests showed that the most significant leakage was through the containment electrical penetrations. Replacement of the original penetration fittings with an improved design using hermetically sealed conductors eliminates this leakage. Significant leakages were also detected at the seats of valves forming a single barrier between the containment and the surrounding compartment. Installation of valves using seats with teflon inserts eliminates this leakage. (auth)

3753 A NUCLEAR HIGH-POWER PROPULSION PLANT FOR A MERCHANT SHIP. E. B. Delson (General Electric Co., Cincinnati). p.46-58 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG. 1964. (In German)

The chief requirements for a ship propulsion system using a reactor were studied. The demands of ship propulsion on a nuclear steam producer are: small size and moderate weight, high steam quality, arrangement for minimum changes in ship's design, reliability, minimum maintenance, fast fuel loading, safety, automation of control system, versatility, low capital and operating costs, and viability. The 630-A reactor and its components are described and diagrams given. The core consists of 85 fully enriched fuel elements arranged in a hexagonal lattice. Water is used as the coolant and moderator, and beryllium is the reflector. Boron rods are used for control. (M.C.G.)

3754 20,000 SHP NUCLEAR ENERGY SHIP PROPULSION WITH A HIGH-TEMPERATURE REACTOR BBC/KRUPP-TYPE, IN A CLOSED GAS TURBINE LOOP. H. G. Schafstall (Arbeitsgemeinschaft BBC-Krupp, Mannheim, Ger.). p.59-67 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

A project study was carried out on a 20000-shp high-temperature reactor of the BBC/KRUPP type for use in ship propulsion. The arrangement of the installation and its efficiency are discussed and diagrams shown. The coolant gas, fuel elements, and containment vessel are described. Safety considerations are discussed. (M.C.G.)

3755 ARRANGEMENT AND COUPLING POSSIBILITIES FOR SHIP PROPULSION WITH A GAS-COOLED HIGH-TEMPERATURE REACTOR, BBC/KRUPP-TYPE. F. Schmiedel (Arbeitsgemeinschaft BBC-Krupp, Mannheim, Ger.). p.68-9 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

The coupling possibilities of a ship propulsion unit, which has a high-temperature reactor as heat source, are discussed. (M.C.G.)

3756 GAS-COOLED BERYLLIUM OXIDE-MODERATED HIGH-TEMPERATURE REACTORS WITH GAS TURBINES FOR SHIP PROPULSION. E. Boehm. p.70-6 "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

A 33000-shp high-temperature reactor with connected gas turbine was designed for ship propulsion. The BeO reactor system, the gas turbine unit, and safety considerations for single-circuit operation are described. (M.C.G.)

3757 GAS TURBINES FOR NUCLEAR POWER PLANTS. K. Bommert (Technische Hochschule, Hanover). p.77-81 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

The heat generated in gas-cooled reactors can be used either for the generation of steam to drive a steam turbine or it can be used directly in a closed-cycle gas turbine. In the latter case the driving medium of the gas turbine is at the same time the cooling medium for the reactor. It follows that this gas must satisfy special conditions given by nuclear considerations. These are fulfilled by helium. The operation of a gas turbine with a working gas of such low density has the consequence that in these turbomachines there appear enthalpy differences per unit mass, which are four to five times those of the usual air turbines. It is shown in an example that, by the use of all technical possibilities, machines can be made which are only slightly larger than the turbomachines of corresponding closed cycle air turbines. In addition the heat exchanger and the coolers were dimensioned for the example under consideration; these are smaller than in customary plants due to the good thermal properties of helium. (auth)

3758 BEHAVIOR OF GRAPHITE REFLECTORS IN THE ROTATION STAND OF GKSS. K. Gerold (Arbeitsgemeinschaft BBC-Krupp, Mannheim, Ger.). p.87-9 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

A reflector in the form of a cubic graphite cylinder for a BBC/KRUPP-type reactor is described and pictures presented. Some examples of reflector construction and results of tests on them in the rotatory test stand are discussed. (M.C.G.)

3759 COMPARATIVE OPERATING COST STUDIES OF SHIPS WITH CONVENTIONAL AND NUCLEAR PROPULSION. G. Mau (Staatliche Schiffsingenieurschule, Flensburg, Ger.). p.90-9 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

A comparative study was made of operating costs for a nuclear powered and a conventionally powered bulk carrier. Data are presented in tables and graphs. Results

indicated that future development of reactors for propulsion of merchant vessels should be carried out. (M.C.G.)

3760 ANALYZATION OF NUCLEAR SHIP COMPETITIVENESS ON THE BASIS OF THE RECENT ECONOMIC STUDIES. G. Reggio (Ansaldo S.P.A., Genoa). p.100-4 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964.

In the last two years some technical-economic studies were made where nuclear ships were considered under a commercial aspect, with the aim of analyzing their competition prospects with conventional ships. Some figures are examined, which arose from these studies, with regard to the weight and dimensions of the hull, outfit, and propelling machinery of nuclear ships embodying particular reactors in order to point out their difference from conventional ships of similar type. The choice of some items affecting the performance and the economy of the plant is considered, and investigations deemed necessary in this connection are outlined. References to the 50,000 tdw nuclear tanker are relative to the studies being developed in the program of the Euratom-FIAT-ANSALDO contract. For this tanker the cargo deadweight obtainable in the case of nuclear or conventional propelling machinery was calculated, taking into account the difference between the two light ship weights, and including the necessary fuel supply. Operating costs, as evaluated in the economic studies considered, were also examined. (auth)

3761 ECONOMIC AND LEGAL PROBLEMS OF INSURANCE OF SHIP REACTORS. H. Moeller (Universität, Hamburg). p.114-19 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

Questions of liability in the operation of ship reactors are discussed according to atomic energy laws and according to the Brussels convention. Insurance on the hull and liability insurance are considered on the basis of legal sources, insurer, interest, insurance merit, hazards, causality, damages, regression, adhesion liability insurance, and premiums. (M.C.G.)

3762 DESIGN AND CHARACTERISTICS OF THE ADVANCED PRESSURIZED WATER REACTOR (FDR) FOR THE GERMAN NUCLEAR RESEARCH SHIP. W. Jahns (Deutsche Babcock and Wilcox-Dampfkessel-Werke AG, Oberhausen, Ger.). p.120-8 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

The construction and functional design of a pressurized water reactor for the German nuclear research ship is described and diagrams presented. The reactor core, steam generator, pressure vessel, primary circulating pump, control rod operation, auxiliary equipment, safety vessel, shielding, nuclear and thermal analyses of the reactor core, control system, instrumentation, and dynamic behavior of the reactor are discussed. (M.C.G.)

3763 NUMERICAL PROCEDURES FOR NUCLEAR DESIGN OF THE FDR CORE. G. Memmert (Interatom, Bensberg, Ger.). p.129-33 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

Difficulties in calculation of the nuclear properties of the FDR core are discussed and special numerical methods for avoiding them are discussed. (M.C.G.)

3764 SPECIAL REQUIREMENTS FOR SHIP REACTORS FROM THE PECULIARITIES OF SHIP PROPULSION. H. Schmerenbeck (Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt mbH., Hamburg). p.134-5 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

Space requirements, safety container of the reactor, effects of motion of the ship on the reactor, results of possible collisions, difficulties in using sea water as the reactor coolant, and the effects of various climatic conditions, due to the mobility of the ship, on the reactor are discussed. (M.C.G.)

3765 PROBLEMS OF INSTALLATION OF THE REACTOR PLANT IN THE RESEARCH SHIP OF THE GESELLSCHAFT FUR KERNENERGIEVERWERTUNG IN SCHIFFBAU AND SCHIFFAHRT mbH. W. Wiebe (Institut für Kernenergie-Schiffsantriebe der Reaktorstation, Hamburg). p.136-40 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

Design of a ship for installation of a reactor for propulsion is discussed. The general plan of the ship is shown in diagrams. Arrangement of the safety shield is described. (M.C.G.)

3766 SPECIAL REQUIREMENTS FOR REACTOR SAFETY ON THE BASIS OF OPERATING CONDITIONS ON A SHIP. O. Kellermann, K. H. Lindackers, and W. Schwarzer (Technische Uberwachungs-Vereim Rheinland ev, Cologne). p.141-7 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

Uses of a nuclear reactor for ship propulsion require special consideration for reactor safety. Construction and arrangement, fuel elements and covering, the primary circulation system, and safety enclosures are considered. Criteria for the selection of fuel elements and cladding are discussed. Consequences of the mobility of the reactor for equipping the ship are reviewed. Safety hazards in the maximum credible accident (melting of core) are discussed. (M.C.G.)

3767 SPECIAL TASKS, WHICH A CLASSIFICATION GROUP SHOULD ACCOMPLISH IN DESIGN AND CONSTRUCTION OF SAFE CONTAINMENT. G. Bourceau and P. Weiss (Bureau Veritas, Paris). p.148-58 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

In order to guard against a possible bad accident and to guarantee the safety of the ship's environment, a special classification group is proposed. The maximum credible accident, mechanical loading of the containment, interior pressure and temperature, mechanical effects of this loading, external pressure, motion of the ship, operating conditions, determination of the permissible leak rate, maximum permissible radiation dose, importance of the fission products, hindering the discharge of fission products, distribution of fission products in the air, and motion of the ship are considered. Preparation of the containment vessel is described, including choice of steel, materials survey, analysis of kinds of stress, pressure testing, tightness testing, and determining the leak rate. (M.C.G.)

3768 THE QUESTION OF COLLISION PROTECTION IN REACTOR SHIPS. G. Woisin (Institut für Kernenergie-Schiffsantriebe der Reaktorstation, Geesthacht, Ger.). p.169-71 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

Types of collisions, possible distributions of deformation, effects of impact force, frequency distributions for collisions at various points on the length of the ship, and a suggested improvement in the arrangement of the reactor in the ship are discussed. (M.C.G.)

3769 SEMI-EMPIRICAL DETERMINATION OF HYDRODYNAMIC CHARACTERISTICS IN SHIP COLLISIONS. K. Drittler (Institut für Reaktorphysik der Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt mbH, Geesthacht, Ger.). p.172-3 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

The hydrodynamic behavior of ships with nuclear propulsion systems in collisions is considered. Equations are presented and their use and accuracy illustrated by an example. (M.C.G.)

3770 THE GEESTHACHT RESEARCH WORK ON OPTIMIZATION OF RADIATION SHIELDING. Erich Bagge (Institut für Reine und Angewandte Kernphysik, Kiel and Institut für Reaktorphysik der GKSS, Hamburg). p.174-80 of "Kernenergieantriebe für Handelsschiffe." Munich, Verlag Karl Thiemig KG, 1964. (In German)

Minimization of weight and volume of radiation shielding for ship reactors is discussed. Layer arrangements of different materials were considered and experiments to test

some arrangements carried out. Results are presented for H_2O–Fe–Pb–polyethylene, Fe–H_2O–Pb, and Fe–H_2O–concrete shields. (M.C.G.)

Research and Test Reactors

Refer also to abstracts 2476 and 3614.

3771 (AE-155) TESTS OF NEUTRON SPECTRUM CALCULATIONS WITH THE HELP OF FOIL MEASUREMENTS IN A D_2O- AND AN H_2O-MODERATED REACTOR AND IN REACTOR SHIELDS OF CONCRETE AND IRON. R. Nilsson and E. Aalto (Aktiebolaget Atomenergi, Stockholm). Sept. 1964. 23p. Dep.(mn).

Foil measurements covering the fast, epithermal, and thermal neutron energy regions were made in the center of the Swedish D_2O-moderated reactor R1, in the pool reactor R2-0, and in different positions in reactor shields of iron, magnetite concrete, and ordinary concrete. Neutron spectra were also calculated for most of these positions, often with the help of a numerical integration of the Boltzmann equation. The measurements and the calculated spectra are presented. (auth)

3772 (CEA-R-2377) MESURE DES TRES BASSES REACTIVITES A PARTIR DE LA REPONSE IMPULSIONNELLE D'UN REACTEUR. DETERMINEE PAR INTERCORRELATION. INTERPRETATION DE CERTAINS RESULTATS. (Measurement of Very Low Reactivities Beginning With the Pulsed Response of a Reactor. Determination by Intercorrelation. Interpretation of Certain Results). Thomas E. Stern, Jean Valat, Austin Blaquiere, and Jean Cazemajou (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay). Aug. 1964. 67p. Dep.(mn).

Measurements of low reactivities carried out on the reactors RUBEOLE and then ULYSSE were carried out. The pulsed response is obtained by a method of intercorrelation between a source excitation of a square-wave form and the resulting output. An interpretation is given for certain results having a space-time origin. (auth)

3773 (CEA-R-2532) RESULTATS D'ENSEMBLE DU FONCTIONNEMENT DES REACTEURS DU CENTRE D'ETUDES NUCLEAIRES DE GRENOBLE. (General Results Concerning the Operation of the Reactors at the Grenoble Nuclear Research Centre). M. Jacquemain and R. Marouby (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Grenoble). 1964. 9p. Dep.(mn).

The operating conditions of MELUSINE, SILOE, and SILOETTE, and improvements made to increase the flux in irradiation rigs and to increase safety and regularity of operation are described. (auth)

3774 (CEA-R-2536) PHYSIQUE DES RAYONNEMENTS ISSUS D'UN REACTEUR A EAU LEGERE. (Physics of Radiation Produced by a Light Water Reactor). Yves Droulers, Claude Meunier, and P. Mas (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Grenoble). 1964. 27p. Dep.(mn).

In the report are brought together the majority of the results of measurements carried out in the light water reactors at the Grenoble Nuclear Research Center (MELUSINE and SILOE) concerning the physical characteristics of the radiation from the core. These measurements concern the energy distribution and the variations of the flux intensity as a function of time and space for the various types of neutron and gamma radiation. Since the results concern two cores of different shape, with or without a beryllium reflector, and with different operational specific powers, it is possible, with the customary precautions, to generalize them to other reactors of the same type. In particular a simplified analytical formed, which has been verified experimentally, is presented for the spectral distribution of fast and intermediate neutrons. All the information concerning the spectra and cross sections required for the measurement of fast neutron fluxes is given. (auth)

3775 (CEA-R-2589) SILOETTE, MODELE NUCLEAIRE DE SILOE. (SILOETTE, Nuclear Mockup of SILOE). Victor Delcroix, Georges Jeanne, Gerard Mitault, and Pierre Schulhof (France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Grenoble). 1964. 73p. Dep.

The SILOETTE mockup of SILOE is described; reactor components and auxiliaries are included. Emphasis is placed on spent-fuel element handling procedures. (R.E.U.)

3776 (HW-59288) SINGLE-REGION SIMULATION OF XENON POISONING IN THE PRTR. W. D. Cameron (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Feb. 20, 1959. Contract AT(45-1)-1350. 16p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Transient and steady-state solutions to the Xe poisoning equations are presented, as applied in PRTR. The equations are solved in the GEDA analog computer. This is a special case of a general type of problem for which a solution is difficult to obtain without the use of a computer. (auth)

3777 (IDO-17009) A TRANSPORT STUDY OF THE NEUTRON FLUX, ADJOINT, AND IMPORTANCE FOR THE ADVANCED REACTIVITY MEASUREMENT FACILITY-II. N. C. Kaufman (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Sept. 1964. Contract AT(10-1)-205. 26p. Dep.; $2.00(cy), 1(mn) OTS.

The ARMF-II reactor (water-moderated, U(235)–Al alloy fuel plate) was studied using the S-XI neutron transport code. Core flux, adjoint, and importance distributions and neutron energy spectra were obtained with samples of PbO_2, $U(238)O_2$, or ThO_2 in the sample position. The results of these calculations at selected energies and positions are presented in graphical form. (auth)

3778 (NASA-TN-D-2210) TWO-DIMENSIONAL FLUX AND CRITICALITY CALCULATIONS FOR THE PLUM BROOK REACTOR. John H. Lynch (National Aeronautics and Space Administration. Lewis Research Center, Cleveland). Oct. 1964. 49p. $1.25(OTS).

A description is given of a four-group neutron diffusion theory model used to calculate flux distributions and criticality effects in the Plum Brook Reactor. Flux distributions obtained using this model are summarized. Also discussed are the spatial dependence of the flux spectrum above thermal energies, the core excess and shutdown reactivities, and the kinetics parameters. (NASA)

3779 (ORNL-P-614) SOME ASPECTS OF LOW-TEMPERATURE IRRADIATION FACILITIES. R. R. Coltman, C. E. Klabunde, and G. F. Fielder (Oak Ridge National Lab., Tenn.). Oct. 1964. Contract W-7405-eng-26. 25p. (CONF-791-1). Dep.(mn); $1.00(cy), 1(mn) OTS.

From Study Group on Research Reactor Experimental Techniques, Bucharest, Oct. 1964.

Considerations in the use of high neutron fluxes and cryogenic techniques in studies of radiation damage and recovery are discussed with specific reference to the ORNL low-temperature irradiation facility. The use of converters and shields to modify the flux is considered. Heat load and cryogenic irradiation hazards are discussed. Refrigerators of various types, including helium and nitrogen type, are discussed in some detail. Finally, temperature measurements are considered. It is concluded that swimming-pool reactors offer advantages for solid-state work. (D.L.C.)

3780 (TID-21248) A MOCK-UP STUDY OF THE JEEP-II RESEARCH REACTOR CORE IN NORA. E. Andersen, D. Babala, K. Bryhn-Ingebrigtsen, A. Drageset, C. H. Millar, N. L. Snidow, and J. Smit (Norway. Institutt for Atomenergi, Kjeller). Apr. 1964. Contract [AT(30-1)-2607]. 42p. (KR-69; NORA-7). Dep(mn); $2.00(cy), 1(mn) OTS.

A series of measurements on a mockup core for the JEEP II research reactor under construction at Kjeller was performed in the NORA zero power facility. The fuel elements used were 11 pin clusters made from 3% enriched UO_2 clad in 304 stainless steel, and the moderator was D_2O. Two cores were studied, one with a lattice pitch

of 20 cm, and the other 17.3 cm. The number of fuel elements in both cores was 19. The experiments were analyzed using standard nuclear codes for D_2O lattices, and theoretical results showed generally good agreement with the experimental data from the NORA reactor. (auth)

3781 DANGER ALARMS AND WARNING INDICATORS IN THE JULICH NUCLEAR RESEARCH CENTER. At. Strom, 10: 61-3(Aug. 1964). (In German)

The alarm and warning system installed in the Julich Nuclear Research Center is briefly described. This includes long-distance alarm nets, loudspeaker systems, sirens, and radio installations. (J.S.R.)

3782 MEASUREMENTS OF THE ISOTHERMAL TEMPERATURE COEFFICIENT OF REACTIVITY FOR THE LIGHT-WATER-MODERATED, 2.1%-ENRICHED UO_2 LATTICES OF THE CORNELL ZERO POWER REACTOR. W. P. Wynn, Jr., David D. Clark, and David J. Osias (Cornell Univ., Ithaca, N. Y.). Trans. Am. Nucl. Soc., 7: 213-14(Nov. 1964).

3783 SHORT-INTERVAL-SERIES PULSING WITH A TRIGA REACTOR. G. H. Miley, H. A. Kurstedt, and G. P. Beck (Univ. of Illinois, Urbana). Trans. Am. Nucl. Soc., 7: 283(Nov. 1964).

3784 SPECTRAL ANALYSIS OF THE SWIMMING POOL BLUE GLOW. G. F. Knoll (Univ. of Michigan, Ann Arbor). Trans. Am. Nucl. Soc., 7: 351-2(Nov. 1964).

3785 IN-CORE EXPERIMENTS WITH A LITHIUM-6 "SANDWICH" FAST NEUTRON SPECTROMETER. R. J. Huber (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 368-9(Nov. 1964).

3786 PREPARATION AND PROPERTIES OF FUEL AND COOLANT FOR MSRE. H. F. McDuffie, J. H. Shaffer, C. F. Baes, Jr., R. E. Thoma, S. Cantor, and F. F. Blankenship (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 400(Nov. 1964).

3787 BORAX V NUCLEAR SUPERHEAT OPERATING EXPERIENCE. J. D. Cerchione, W. R. Wallin, and R. C. Rice (Argonne National Lab., Idaho Falls, Idaho). Trans. Am. Nucl. Soc., 7: 489-90(Nov. 1964).

3788 DESIGN AND OPERATING EXPERIENCE OF THE ESADA—VALLECITOS EXPERIMENTAL SUPERHEAT REACTOR (EVESR). P. W. Ianni, J. R. Fritz, and D. D. Law (General Electric Co., San Jose, Calif.). Trans. Am. Nucl. Soc., 7: 490-1(Nov. 1964).

3789 AN ADVANCED SOLUTION-PULSED REACTOR. M. Silberberg, P. Spiegler, and R. Cordy (Atomics International, Canoga Park, Calif.). Trans. Am. Nucl. Soc., 7: 497-8(Nov. 1964).

3790 PLUTONIUM RECYCLE TEST REACTOR CONTAINMENT VESSEL TEST EXPERIENCE. D. R. Koberg and R. G. Clark (General Electric Co., Richland, Wash.). Trans. Am. Nucl. Soc., 7: 499-500(Nov. 1964).

3791 ENERGY CONSIDERATIONS IN THE SPERT I-D DESTRUCTIVE PRESSURE PULSE. S. Zivi (Space Technology Labs., Inc., Redondo Beach, Calif.). Trans. Am. Nucl. Soc., 7: 501(Nov. 1964).

3792 PRELIMINARY CONSIDERATIONS ON THE SAFETY ANALYSIS OF FARET. P. J. Persiani, A. Watanabe, U. Wolff, S. Grifoni, and B. Warman (Argonne National Lab., Ill.). Trans. Am. Nucl. Soc., 7: 501-2(Nov. 1964).

3793 DESIGN CONSIDERATIONS FOR THE PULSED-SOURCE REACTOR SORA. J. A. Larrimore and V. Raievski (Euratom, Ispra, Italy). Trans. Am. Nucl. Soc., 7: 513-14(Nov. 1964).

3794 PROMPT-NEUTRON LIFETIME CALCULATIONS IN FAST ASSEMBLIES. T. Asaoka, H. Kschwendt, W. Matthes, and H. Rief (Euratom, Ispra, Italy). Trans. Am. Nucl. Soc., 7: 514-15(Nov. 1964).

3795 DESCRIPTION OF ESSOR, A HEAVY WATER MODERATED ORGANIC COOLED SPECIFIC TEST REACTOR. C. Garric and P. -Y. Tiberghien (Euratom, Ispra, Italy). Trans. Am. Nucl. Soc., 7: 521-2(Nov. 1964).

3796 SWIMMING POOL TYPE REACTOR ROD CONTROL MEANS. William D. Whitehead. U. S. Patent 3,122,683. Feb. 25, 1964. Filed Oct. 30, 1959.

An improved electromagnetic holding control system is designed for the safety rods of a swimming-pool reactor. The control system uses a transistorized magnetic amplifier circuit, and it gives more reliable service and is simpler to adjust. (D.L.C.)

3797 FUEL ELEMENT AND CORE FOR A NEUTRONIC REACTOR. Frank E. Jamerson. U. S. Patent 3,157,581. Nov. 17, 1964. Filed May 4, 1961.

A fuel plate design for a beam port reactor is described. The plate has fuel-free sections which align with the beam ports providing a slow neutron flux. This split-core reactor can also be used to produce fast neutrons for experimental purposes. (T.R.H.)

WASTE DISPOSAL AND PROCESSING

3798 (UJV-1111/64) OTVERZHDENIE RADIOAKTIVNYKH OTKHODOV METODOM TSEMENTIROVANIYA. (Solidification of Radioactive Wastes by Cementing). L. Skheibalova and I. Novotnyi (Ceskoslovenska Akademie Ved. Ustav Jaderneho Vyzkumu, Rez). [1964]. 13p. Dep.(mn)

Solidification of radioactive wastes in concrete blocks was studied considering the mechanical properties of various cementing materials. The best results were obtained with portland cement-350. Procedures for solidification and weight ratios for mixing are given. A diagram of the installation is included. (R.V.J.)

3799 THE TREATMENT AND DISPOSAL OF LIQUID RADIOACTIVE WASTES FROM MEDICAL AND INDUSTRIAL USERS AND RESEARCH CENTERS. R. H. Burns (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Foederation Europaeischer Gewaesserschutz, Informationsbl., No. 10, 37-47(May 1964).

Potential hazards in the treatment and disposal of radioactive wastes are assessed. Some of the radioisotopes in use in industry and medicine are listed and the liquid wastes arising from these uses are considered. The advantages and disadvantages of both concentration and containment and controlled dispersal to the environment are discussed. Legislation for control of waste disposal is reviewed. Methods used at individual sites and at central treatment and disposal centers are described. (M.C.G.)

3800 TECHNICAL SOLUTION TO THE CONTINUOUS MONITORING OF THE RADIOACTIVITY OF LIQUID WASTES AND THEIR RECEIVING WATERS. Pierre Bovard (Commissariat à l'Energie Atomique, Paris). Foederation Europaeischer Gewaesserschutz, Informationsbl., No. 10, 53-5(May 1964). (In French)

The control of radioactive waste water discharge into rivers consists of three stages: continuous sampling, global measurements, and detailed measurements. Equipment for monitoring water is classed in four categories: equipment for direct measurement, integrating resin units, devices recording the radioactivity of dry aerosols, and devices recording the radioactivity of dry extracts. Both radiochemical analysis and gamma spectroscopy can be used for direct measurement. To control effluent discharge, specific overall activity, specific activity of certain elements, amount of effluent discharges, and effective amount of activity discharged measured in curies must be known. Various types of monitoring systems are described. (M.C.G.)

3801 THE TRIALS OF PEAT APPLICATION TO SORPTIVE DECONTAMINATION OF WASTES, PRELIMINARY PURIFIED, FORMED AS THE RESULT OF THE SULFURIC ACID TREATMENT ON URANIUM ORES. Rafal Wlodarski (Instytut Badan Jadrowych, Warsaw). Nukleonika, 9: 496-8(1964). (In Polish)

3802 A CONCEPT AND FIELD-SCALE TEST OF DISPOSAL OF HIGH-ACTIVITY POWER REACTOR WASTES IN SALT MINES. R. L. Bradshaw, J. O. Blomeke, W. J. Boegly, Jr., F. L. Parker, J. J. Perona, and W. F. Schaffer, Jr. (Oak Ridge National Lab., Tenn.). Trans. Am. Nucl. Soc., 7: 399-400(Nov. 1964).

3803 METHOD OF TREATING RADIOACTIVE WASTE. Lane A. Bray and Earl C. Martin (to U. S. Atomic Energy Commission). U. S. Patent 3,158,577. Nov. 24, 1964.

A method is described for reducing the concentrations of nitric acid and nitrous and nitrate ions in a nuclear fuel waste solution. Disaccharide is added to the solution in the ratio of one mole to from ~17 to 22 moles of nitric acid and nitrous and nitrate ions. The solution is heated from about 85°C to the boiling point for at least four minutes, and thereafter from between 50°C and the boiling point until the disaccharide is destroyed. (AEC)

GENERAL AND MISCELLANEOUS

3804 (BNL-883) SCISRS—SIGMA CENTER INFORMATION STORAGE AND RETRIEVAL SYSTEM. Jerry M. Friedman and Marc Platt (Brookhaven National Lab., Upton, N. Y.). July 1964. Contract AT(30-2)-Gen-16. 97p. Dep.; $3.00(OTS).

The SCISRS was written for the IBM 7094 to service the data processing needs of the Sigma Center and its enormous cross-section files. The data input (SPASM) and retrieval (RETREV) functions and their operation are described. (D.L.C.)

3805 (BNL-7613) ON A THEOREM ON THE PLANARITY OF A TOPOLOGICAL GRAPH. Y. Shimamoto and J. N. Snyder (Brookhaven National Lab., Upton, N. Y.). [Oct. 31, 1963]. Contract AT(30-2)-Gen-16. 7p. Dep. (mn); $1.00(cy), 1(mn) OTS.

A theorem amenable to computer application for determining the planarity of a topological graph is proved: a necessary and sufficient condition that a graph be planar is that it possess at least one independent set of canonical circuits. (R.E.U.)

3806 (KR-79) QUARTERLY PROGRESS REPORT, APRIL–JUNE 1964. (Norway. Institutt for Atomenergi, Kjeller). Oct. 1964. 38p. Dep.(mn).

The operation and development of the JEEP, NORA, and JEEP II reactors are described. Results are presented of studies on neutron spectra in UO_2 lattices moderated by H_2O–D_2O in NORA, and on the image of the Fermi surface in the magnon spectrum of F.C.C. cobalt. A combined crystal-chopper unit for magnetic inelastic scattering experiments is described. The sintering of UO_2 and the fabrication of Al-canned fuel elements for various reactor are reported. Studies of the corrosion of mild steel in water are summarized, and a new corrosion test loop is described. Various projects in reprocessing and waste treatments are described. The isotope production and health physics programs are discussed. (D.L.C.)

3807 (LADC-6130) A COMPARATIVE STUDY OF STABILIZER CAPACITY TOWARD NITROGEN TETROXIDE. Stanley K. Yasuda (Los Alamos Scientific Lab., N. Mex.). [196?]. Contract W-7405-eng-36. 18p. Dep. (mn); $1.00(cy), 1(mn) OTS.

Various common and potentially useful stabilizers for nitrate esters were compared on the basis of their reactivities toward N_2O_4 by means of a gasometric titration procedure. In terms of weight of N_2O_4 reacted per unit weight of stabilizer, the following order of effectiveness was obtained: diphenylamine > N,N′-diphenylbenzidine = N,N′-diethyl-N,N′-diphenylurea > 2-nitrodiphenylamine > s-diphenylurea = 2,4-dinitrodiphenylamine. (auth)

3808 (LADC-6164) EFFICIENT APPLICATION OF KERR CELL CAMERAS. W. C. Davis (Los Alamos Scientific Lab., N. Mex.). [nd]. Contract W-7405-eng-36. 8p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A discussion is presented of the energy-limited information-gathering characteristics of a Kerr cell camera. Equations are given for obtaining maximum information from a source of given equivalent blackbody brightness temperature. The equations are used to maximize the area of the film which receives an unvignetted image. Lens pupil shapes and image vignetting are considered briefly. A graph is given for finding the optimum exposure time. (D.L.C.)

3809 (ORNL-P-654) CHROMOSOME PAIRING, CROSSING OVER AND DISJUNCTION IN DROSOPHILA MELANOGASTER. Rhoda F. Grell (Oak Ridge National Lab., Tenn.). [1964]. Contract W-7405-eng-26. 38p. (CONF-734-3). Dep.(mn); $2.00(cy), 1(mn) OTS.

Results are summarized from studies of the meiotic mechanism in Drosophila. 37 references. (C.H.)

3810 (PNE-215F) STRUCTURE RESPONSE. S. E. Warner and J. T. Cherry (California. Univ., Livermore. Lawrence Radiation Lab.). June 1964. Project SEDAN. Contract [W-7405-eng-48]. 20p. Dep.; $1.00(cy), 1(mn) OTS.

The response of structures to ground motion resulting from underground nuclear explosions is dictated at least by structural characteristics, ground motion, and coupling between ground and structure. The performance of a simple mechanical oscillator of known structural characteristics is given and measured ground motions at the oscillator resulting from the Sedan event are listed. From ground motion data and oscillator characteristics, oscillator performance is predicted. A comparison of expected results with actual oscillator performance is included. (auth)

3811 (TID-20074) N-BASE ADDUCTS OF METAL β-DIKETONATES. W. R. Walker (Duquesne Univ., Pittsburgh). [1963]. Contract AT(30-1)-1922. 3p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The preparation of two adducts of the type $M(TTA)_2(4\text{-methylpyridine})_2$, where M = Zn and Cu and TTA = thenoyltrifluoroacetone, is reported. The adducts were prepared by crystallizing the Zn and Cu thenoyltrifluoroacetonates from boiling 4-methylpyridine. (D.L.C.)

3812 (TID-21287) [PROGRESS REPORT ON PROTEIN SYNTHESIS IN MAMMALIAN PANCREAS, FINAL 1954–1964]. (Utah. Univ., Salt Lake City. Coll. of Medicine). Contract AT(11-1)-305. 24p. Dep.(mn); $1.00(cy), 1(mn) OTS.

Data are summarized from a series of studies on protein synthesis in the mammalian pancreas. Results are reported from studies on the assay and inhibition of ribonuclease; factors affecting the secretion and synthesis of mouse pancreas enzymes; protein synthesis by beef pancreas slices; the preparation and properties of beef pancreas ribonucleoprotein fractions; and studies of protein synthesis by cell-free systems. A list is included of 17 publications resulting from work performed during the period covered by this report. (C.H.)

3813 (TID-21326) ANNEALING OF STRESS ANISOTROPY IN THIN IRON FILMS (thesis). Technical Report No. 32. J. Riesenfeld (Case Inst. of Tech., Cleveland). Mar. 1964. Contract AT(11-1)-623. 38p. Dep.(mn); $2.00(cy), 1(mn) OTS.

A study has been made of the effect of annealing on stress and stress anisotropy in thin iron films. The films were deposited at oblique incidence in the thickness range 200 to 800 A and annealed in vacuum in steps up to 200°C. Before annealing, the ratio of the stress in the plane of incidence to the stress perpendicular to this direction ranged from 0.9 for the thickest films to 2.0 for the thinnest. On annealing, both the stress and stress ratio decreased for all thicknesses, the stress ratio in every case falling below 1.0 after annealing at 200°C. The annealing behavior is explained on the basis of the elimination of some crystallite boundaries and a reduction in thickness independent tensile stress. (auth)

3814 (UCRL-7527) A CONVENIENT METHOD FOR OBTAINING WEIBULL'S MODULUS, m. E. Robinson (California. Univ., Livermore. Lawrence Radiation Lab.). Sept. 11, 1963. Contract W-7405-eng-48. 11p. Dep.(mn); $1.00(cy), 1(mn) OTS.

The simplified form of the Weibull distribution function $S = \exp\left[-\int_V (\sigma/\sigma_0)^m dV\right]$ can, in general, be reexpressed as $S = \exp - \{(\sigma/\sigma_a)\,\Gamma[(1/m)+1]\}^m$, where σ_a is the mean value of strength. The relation between the survival probability at any stress $k\sigma_a$ (k may be greater or less than one) and m is plotted and provides a convenient method of finding m. The plot provides a perspective of survival probabilities for any range of m and can be used to directly test approximations of data in terms of survival probabilities. The plot allows several separate determinations of m which examine various portions of the data and locate stress regions within which deviation from the assumed distribution occurs. (auth)

3815 (UCRL-11130) THE CRYSTAL STRUCTURE OF SODIUM FLUOSILICATE. Allan Zalkin, J. D. Forrester, and David H. Templeton (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley. Dept. of Chemistry). Nov. 1963. Contract W-7405-eng-48. 17p. Dep.(mn); $1.00(cy), 1(mn) OTS.

A study by x-ray-diffraction showed that Na_2SiF_6 is hexagonal (trigonal) with a = 8.859, c = 5.038 Å (each ± 0.002 Å), Z = 3, d_x = 2.74 g cm^{-3}. The space group is $P321$. The SiF_6 groups are almost regular octahedral with Si–F = 1.695 Å (corrected for thermal motion). Each sodium has 6 fluorine neighbors at the corners of a considerably distorted octahedron. Twinning which superimposes hkl and khl is common. The structure was determined with data from a twinned specimen which contained unequal amounts of the two orientations. (auth)

3816 (JPRS-27049) TRANSLATIONS ON COMMUNIST CHINA'S SCIENCE AND TECHNOLOGY NO. 117. Translated from K'o Hsueh T'ung Pao, No. 7, 565-95; 607-19(July 17, 1964). 84p. (TT-64-51305). $3.00(OTS).

Five selected articles are presented which discuss respectively palaeoanthropology research, productivity economics, microorganic inversion in steroid compounds, tritium-tagged compounds in pharmacology, and the Mössbauer effect in ^{57}Fe. Separate abstracts were prepared for the two articles dealing with tritium-tagged pharmaceuticals and with the Mössbauer effect. (D.L.C.)

For abstracts of individual papers see: 2010 and 2893.

3817 SELF-CONTAINED VARIABLE-ENVIRONMENT PRESSING DIE. Donald M. Olsen (to U. S. Atomic Energy Commission). U. S. Patent 3,156,011. Nov. 10, 1964.

A self-contained, variable-environment pressing die is described in which the die cavity is connected by valve to vacuum and pressurized-gas systems and in which resistance-heating elements are contained in a hollow portion of the die wall, so that pressure and/or temperature may be varied readily before, during, and/or after pressing operations. (AEC)

3818 METHOD OF SEPARATING NUCLEOTIDES. J. X. Khym (to U. S. Atomic Energy Commission). U. S. Patent 3,157,637. Nov. 17, 1964.

A method is described for separating di-, tri-, and tetraphosphates of adenosine, uridine, cytidine, and guanosine from each other and from other substances by extraction from an aqueous solution with an organic solution of a primary aliphatic amine salt. (AEC)

3819 BARHAUSEN OSCILLATION ELIMINATION MEANS. G. L. Anderson and J. P. Hoice (to U. S. Atomic Energy Commission). U. S. Patent 3,158,815. Nov. 24, 1964.

An electrical circuit which eliminates undesirable electron oscillations in blocking oscillators is described. A dropping resistor is placed in series with the control grid of a multielement vacuum tube, and a diode is placed between the anode of the tube and the dropping resistor. The diode is oriented to conduct when the control grid tends to become positive with respect to the anode, thereby establishing a finite negative grid potential with respect to the anode, the magnitude of which is dependent upon the voltage drop across the dropping resistor. (AEC)

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This index contains entries for this period for all report literature and, in addition, for certain published literature items for which it is felt that a corporate approach is especially desirable, e.g., symposia, conference proceedings, and meetings.

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Negative climb of prismatic dislocation loops in Al–7.2 at.% Mg alloy, 19: 2806 (UCRL-11239)
Optical-pumping transients in Rb and Cs vapors, 19: 2963 (UCRL-11636)
Range difference between π^+ and π^- in emulsion, 19: 3029 (UCRL-11518)
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Vapor pressure of Mn activities in Fe–Mn alloys, 19: 2276 (UCRL-11575)
Variational method in e^2-H scattering, 19: 2962 (UCRL-11628)

CALIFORNIA. UNIV., LA JOLLA.
Long wavelength oscillations of quantum plasma in uniform magnetic field. II., 19: 3394 (AD-602039)
0.5 Bev/c beam transport system, 19: 2928 (UCRL-11086)

CALIFORNIA. UNIV., LIVERMORE. LAWRENCE RADIATION LAB.
Computation of self-consistent potential distributions in collisionless plasma, 19: 3399 (UCRL-7660-T)
Corrosion of BeO by H_2O vapor, 19: 2748 (UCRL-7663)
Development of LiF dosimetric material, 19: 2608 (UCRL-12151)
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Structure response, Project SEDAN, 19: 3810 (PNE-215F)
Theory of nuclear explosions in a cavity, 19: 2473 (UCRL-7916)
Venting measurements, Project Pre-Buggy, 19: 2556 (PNE-301-F)

CANADIAN GENERAL ELECTRIC CO., LTD., PETERBOROUGH, ONT.
Boiler room pressures following potential rupture of main coolant line in NPD-2, 19: 3610 (AECL-1930)

CANADIAN NUCLEAR ASSN., TORONTO.
Research and development brief on HWR, 19: 3619 (64-CNA-101)

CARNEGIE INST. OF TECH., PITTSBURGH.
S-matrix theory, 19: 3113 (CAR-882-1)

CASE INST. OF TECH., CLEVELAND.
Annealing of stress anisotropy in thin Fe films, 19: 3813 (TID-21326)
Electric resistivity of thin Ni films deposited in ultra-high vacuum, 19: 2799 (COO-623-101)
Low-temperature thermal expansion coefficient of LiF, 19: 2270 (COO-623-103)

ČESKOSLOVENSKÁ AKADEMIE VĚD. ÚSTAV JADERNÉHO VÝZKUMU, REZ.
Localization of energy in radiolysis of solutions. VI., 19: 2375 (UJV-1119/64)
Solidification of radioactive wastes by cementing, 19: 3798 (UJV-1111/64)

COLUMBIA UNIV., NEW YORK.
Neutron cross sections for neutron attenuation problems, 19: 3454 (TID-21294)

D

DELFT, NETHERLANDS. TECHNISCHE HOGESCHOOL.
Reactor calculations with group diffusion equations on digital computers, 19: 3518 (NP-14429)

DILWORTH, SECORD AND ASSOCIATES LTD., TORONTO.
Boiler room pressures following potential rupture of main coolant line in NPD-2, 19: 3610 (AECL-1930)

DOW CHEMICAL CO. ROCKY FLATS DIV., GOLDEN, COLO.
Liquid α-γ counter for simultaneous determination of Pu and Am, 19: 2606 (RFP-439)
What is the actual resolution of shadowed replicas?, 19: 2578 (RFP-389)

DU PONT DE NEMOURS (E. I.) & CO. SAVANNAH RIVER LAB., AIKEN, S. C.
Factors controlling chloride stress corrosion of type 304 stainless steel, 19: 2745 (CONF-778-3)

DU PONT DE NEMOURS (E. I.) & CO. SAVANNAH RIVER PLANT, AIKEN, S. C.
Factors controlling chloride stress corrosion of type 304 stainless steel, 19: 2745 (CONF-778-3)

DUQUESNE UNIV., PITTSBURGH.
N-base adducts of metal β-diketonates, 19: 3811 (TID-20074)

E

EDGERTON, GERMESHAUSEN AND GRIER, INC., LAS VEGAS, NEV.
SNAPTRAN 2/10A-3 photography, 19: 3715 (EGG-1183-1071)

EUROPEAN ATOMIC ENERGY COMMUNITY.
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Oscillographic polarography in molten nitrates. I., 19: 2271 (EUR-1908.e)
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Rapsodie—neutronics, 19: 3613 (CEA-R-2450)
Separation of terphenyl mixtures, 19: 2202 (EUR-1895.d)
Steel as material for pressure vessel "Rapsodie", 19: 2718 (CEA-TP-1593)

EUROPEAN ATOMIC ENERGY COMMUNITY. CENTRAL NUCLEAR MEASUREMENTS BUREAU, GEEL, BELGIUM.
Data handling instrumentation in CBNM, 19: 2573 (EUR-2101.e)

EUROPEAN ATOMIC ENERGY COMMUNITY. EUROPEAN SCIENTIFIC

DATA PROCESSING CENTER, ISPRA, ITALY.
AIREK-MOD—modified kinetic code AIREK II, 19: 3513 (EUR-1914.e)
EUROPEAN ATOMIC ENERGY COMMUNITY. JOINT NUCLEAR RESEARCH CENTER, ISPRA, ITALY.
AIREK-MOD—modified kinetic code AIREK II, 19: 3513 (EUR-1914.e)
Extraction of U(VI) from H_2SO_4–HNO_3–H_2O solutions, 19: 2203 (EUR-1912.i)
Oscillographic polarography in molten nitrates. I., 19: 2271 (EUR-1908.e)
Pyrolytic decomposition of terphenyls, 19: 2358 (EUR-1647.e)
EUROPEAN COMPANY FOR THE CHEMICAL PROCESSING OF IRRADIATED FUELS, MOL, BELGIUM.
In-line instrumentation at Eurochemic, 19: 2445 (NP-14343(p.IIg1-7))
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EUROPEAN NUCLEAR ENERGY AGENCY, PARIS.
Colloquy on instrumentation in plants for chemical reprocessing of irradiated fuels, Paris, 11/63, 19: 2436 (NP-14343)
Contamination buildup onto various polished surfaces from dilute solutions of Pu, 19: 2747 (NP-14343(Discussion, Session II))
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Solving of Eurochemic's instrumentation problems, 19: 2441 (NP-14343 (p.If1-13))
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA.
Azimuthal distribution of beam losses in cyclotron, 19: 2923 (CERN-64-45)
Nanosecond pulse generator of 200-kv amplitude, 19: 2571 (CERN-64-46)

F

FISH AND WILDLIFE SERVICE. BUREAU OF COMMERCIAL FISHERIES, ANN ARBOR, MICH.
Irradiation preservation of fish, fruits and vegetables, 19: 2066 (COO-1283-12)
FRANCE. COMMISSARIAT À L'ENERGIE ATOMIQUE, PARIS.
Improvement of continuous nuclear analysis in irradiated fuel reprocessing plants, 19: 2444 (NP-14343(p.IIc1-12))
Instrumentation and control for UP-2 plant, 19: 2447 (NP-14343 (p.IIIc1-5))
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, FONTENAY-AUX-ROSES.
Continuous dosage of U in mixer-settler battery, 19: 2217 (NP-14343 (p.IIe1-12))
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FRANCE. COMMISSARIAT À L'ENERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, GRENOBLE.
Operation of reactors at CENG, 19: 3773 (CEA-R-2532)
Physics of radiation produced by light water reactor, 19: 3774 (CEA-R-2536)
SILOETTE, nuclear mockup of SILOE, 19: 3775 (CEA-R-2589)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, SACLAY.
Accuracy of methods used for measuring very low reactivities, 19: 3506 (CEA-R-2229)
Cadmium in solution in EL-4 moderator, 19: 3618 (CEA-R-2504)
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Gas–D_2O reactor contained in pressure vessel, 19: 3617 (CEA-R-2501)
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Sampling and measurement of air radioactivity, 19: 2531 (NP-14284)
Spatial flux instabilities and their control in reactors, 19: 3615 (CEA-R-2480)
Transport and deposition of U, 19: 2279 (CEA-tr-R-1764)
FRANCE. COMMISSARIAT A L'ENERGIE ATOMIQUE. CENTRE DE PRODUCTION DE PLUTONIUM DE MARCOULE, CHUSCLAN.
Problems encountered at Marcoule, 19: 2437 (NP-14343(p.Ib1-10))
FRANKFURT AM MAIN. UNIVERSITAT.
Bibliography on instruments and measuring techniques in nuclear physics, 19: 2598 (AED-C-06-10)
FRANKLIN INST., PHILADELPHIA.
X-ray effects caused by defects in metals, 19: 2803 (NYO-2994-2)

G

GARRETT CORP. AIRESEARCH MFG. DIV. OF ARIZONA, PHOENIX.
Materials investigation, SNAP 50/SPUR program. I., 19: 2794 (APL-TDR-64-116(Pt.I))
GENERAL ATOMIC DIV., GENERAL DYNAMICS CORP., SAN DIEGO, CALIF.
Breeding potential of TARGET 1000-Mwe HTGR, 19: 3623 (GAMD-4592)
ESTA—EBOR system transient analysis, 19: 3622 (GAMD-4447)
Mean emission time correction for measurement of stationary spectra, 19: 3514 (GAMD-4131)
Optimum thickness of annular fuel compact yielding minimum temperature for given heat flux, 19: 3588 (GAMD-5004)
Prog. rpt. on EBOR program, 9/62, 19: 3620 (GA-3561)
Prog. rpt. on EBOR program, 12/62, 19: 3621 (GA-3830)
TARGET pre-stressed concrete vessel ceiling model experimental stress analysis, 19: 3624 (GAMD-5049(Rev.))
GENERAL DYNAMICS/FORT WORTH. DIV. OF GENERAL DYNAMICS CORP., FORT WORTH, TEX.
Effects of radiation on ceramic-bonded solid-film lubricants, 19: 2855 (FTDM-3053)
Monte Carlo procedure for radiation transport and heating studies, 19: 3717 (FZK-156)
NERVA components irradiation program. I., 19: 3718 (FZK-184-1)
Reactor shielding problems for spacecraft applications, 19: 3716 (FZK-154)
GENERAL DYNAMICS/POMONA, CALIF.
Nuclear cloud sampling system, 19: 2533 (UCRL-13126)
GENERAL ELECTRIC CO. ADVANCED TECHNOLOGY SERVICES, CINCINNATI.
Prog. rpt. on high-temperature materials, 10/15/64, 19: 2800 (GEMP-40A)
GENERAL ELECTRIC CO. ATOMIC POWER EQUIPMENT DEPT., SAN JOSE, CALIF.
FLARE—three-dimensional BWR simulator, 19: 3628 (GEAP-4598)
Round-robin analysis for C in Na, 19: 2210 (GEAP-4602)
1000-MWe BWR plant feasibility study, 19: 3626 (GEAP-4476(Vol.II))
1000-MWe BWR plant feasibility study, 19: 3627 (GEAP-4476(Vol.III))
1000-MWe BWR plant feasibility study, 19: 3625 (GEAP-4476(Vol.I))
GENERAL ELECTRIC CO. HANFORD ATOMIC PRODUCTS OPERATION, RICHLAND, WASH.
Adsorption of Cs and Sr on zeolites, 19: 2272 (HW-SA-3199)
Analog computer simulation for PRCF study, 19: 3516 (HW-83296)
Annealing effects on H embrittlement in inner supports, 19: 2720 (HW-80178)
Calibration of Staplex portable air samplers, 19: 2554 (HW-73341)
Elastic constants of single-crystal UO_2, 19: 2801 (HW-SA-3241)
Evaluating corrosion resulting from repeated chemical cleaning, 19: 2746 (HW-SA-2333(Rev.))
Flareless tubing fitting, 19: 2475 (HW-81973)
Fuels recycle pilot plant, 19: 2433 (HW-SA-3655)
Hydride embrittlement of N-fuel inner supports, 19: 3710 (HW-80117)
Irradiation behavior of high-purity U, 19: 2856 (HW-79559)
Irradiation of U–Pu oxide, 19: 2857 (HW-SA-3129)

Measurement of Be on air filters, 19: 2211 (HW-82624)
Nomograph for finding concentration changes in Nth vessel of a series, 19: 2466 (HW-SA-3261)
Nondestructive testing research, 19: 2526 (HW-SA-3578)
Nuclear characteristics of some compact, water-moderated Pu burners, 19: 3651 (HW-79977)
Organic radicals formed in irradiated aqueous solution, 19: 2371 (HW-SA-3066)
Physics statics calculation recipes for Pu burners, 19: 3589 (HW-82043)
Plutonium absorption, evaluation and treatment, 19: 2183 (HW-SA-3730)
Plutonium-bearing fuel element welding facility, 19: 2765 (HW-SA-3486)
Power spectrum and cross spectrum analysis of random signals, 19: 3515 (HW-82397)
Recuplex incident, April, 1962—stack emission, 19: 2555 (HW-77345)
Redox plant demineralized water, 19: 2431 (HW-77023)
Single-region simulation of Xe poisoning in PRTR, 19: 3776 (HW-59288)
Solvent extraction of Cs, 19: 2432 (HW-80876)
Specification for logarithmic radiation monitor, 19: 2607 (TID-21291)
Treatment of wounds contaminated with Pu, 19: 2552 (HW-SA-3676)

GENERAL ELECTRIC CO. MISSILE AND SPACE DIV., VALLEY FORGE SPACE TECHNOLOGY CENTER, KING OF PRUSSIA, PENNA.
Application of nuclear electrical power to manned orbiting space stations. II., 19: 3712 (64SD647)
Spacecraft and powerplant integration problems, 19: 3713 (64SD892)

GENERAL ELECTRIC CO. VALLECITOS ATOMIC LAB., SAN JOSE, CALIF.
Mixed Spectrum Superheat critical experiments, 19: 3629 (GEAP-4620)

GENERAL NUCLEAR ENGINEERING CORP., DUNEDIN, FLA.
Power Reactor Technology, Vol. 7, No. 4, 19: 3661

GEORGIA INST. OF TECH., ATLANTA. ENGINEERING EXPERIMENT STATION.
Fused silica manual, 19: 2805 (TID-21312)
Prog. rpt. on determination of uniformity of mixing cement and bituminous concrete by isotopes, 3/61–12/62, 19: 2221 (SRO-79)
Reactions in Al–34 wt % U_3O_8 dispersions, 19: 2804 (TID-21311)

GT. BRIT. NATIONAL INST. FOR RESEARCH IN NUCLEAR SCIENCE. RUTHERFORD HIGH ENERGY LAB., CHILTON, BERKS, ENGLAND.
Dialect of FORTRAN accepted by Orion FORTRAN compiler, 19: 2709 (NIRL/R/72)

GT. BRIT. RADIOCHEMICAL CENTRE, AMERSHAM, BUCKS, ENGLAND.
Radioactive isotope dilution analysis, 19: 2261
Selected references to tracer techniques, 19: 2675

H

HYDRONAUTICS, INC., LAUREL, MD.
Mechanical properties of metals and their cavitation damage resistance, 19: 2714 (AD-606050)

I

INDIANA UNIV., INDIANAPOLIS. MEDICAL CENTER.
Oxygen effect and selectivity of radiolesions in mammalian neuraxis, 19: 2061 (BNL-8451)

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA.
Isotopes and radiation in soil-plant relations research, 19: 1999
Low-background high-efficiency Geiger-Mueller counter, 19: 2652

INTERNATIONALE ATOMREAKTORBAU G.M.B.H., BENSBERG, GERMANY.
Separation of terphenyl mixtures, 19: 2202 (EUR-1895.d)

ISRAEL. ATOMIC ENERGY COMMISSION, REHOVOTH.
Activities in the molten Ag–$NaNO_3$ system, 19: 2273 (IA-941)
Nuclear cross sections for fast reactors, 19: 3476 (IA-980)

ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, BOLOGNA.
Buildup factors of concrete, 19: 3456 (ORNL-tr-349)

ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, MILAN.
Continuous analysis of U contents and free acidity in uranyl nitrate solutions, 19: 2216 (NP-14343(p.IIdi-5))
Eurex plant instrumentation and control, 19: 2440 (NP-14343(p.IeI-14))

ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, ROME.
Determination of S in terphenyls by reduction using Raney Ni, 19: 2220 (RT/CHI(64)-15)
Fission product release from UO, particles in Na, 19: 2729 (RT/CHI(64)-8)

J

JAPAN ATOMIC ENERGY RESEARCH INST., TOKYO.
Absorbed dose from external β source, 19: 2553 (JAERI-1065)
Behaviors of Kr and Xe in U metal, 19: 2721 (JAERI-4030)
Bibliography on analytical chemistry of Pu, 19: 2213 (JAERI-4028)
Dynamic analysis of natural circulation BWR, 19: 3652 (JAERI-1061)
Status report of shielding investigation in Japan, 19: 3452 (JAERI-4029)

JOINT INST. FOR NUCLEAR RESEARCH, DUBNA, U.S.S.R.
Asymptotic properties of some Hamiltonians encountered in nuclear physics. I., 19: 3234 (JINR-P-1744)
Determination of ⅜, ⅝ isobar contribution to inelastic π^--p interaction processes, 19: 3024 (JINR-P-1746)
Fission cross section of U-235 for neutrons of resonance energies, 19: 3235 (JINR-P-1761)
Neutron spectra in heavy ion interaction with medium nuclei, 19: 3236 (JINR-P-1765)
Niobium and Rb neutron resonances and radiation widths, 19: 3238 (JINR-P-1771)
π^--Mesoatomic processes in hydrogenous substances, 19: 3237 (JINR-P-1767)
Pion charge exchange cross section at 4 Bev/c, 19: 3027 (JINR-P-1782)
Probability of pion radiative absorption in D, 19: 3026 (JINR-P-1768)
Synthesis and identification of isotope of Element 104, 19: 3233 (JINR-D-1818)
Two radiative decay events of $K^+ \rightarrow \pi^+ + \pi^0 + \gamma$, 19: 3025 (JINR-P-1763)

L

LESSELLS AND ASSOCIATES, INC., WALTHAM, MASS.
Specification guidelines for nuclear pressure vessels, 19: 3487 (NYO-3416-1)

LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Analog simulation of Kiwi reactor control, 19: 3721 (LA-DC-6652)
Anomalous dispersion corrections computed from relativistic Hartree-Dirac-Slater wave functions, 19: 2961 (LADC-6146)
Critical mass survey of U^{233}–U^{235}–C system, 19: 3013 (LA-DC-6537)
Efficient application of Kerr cell cameras, 19: 3808 (LADC-6164)
Evaluation of radiation hazards in manned space flight, 19: 2184 (LA-DC-6681)
Existence theorems for quasi-linear elliptic partial differential equations in n variables, 19: 2708 (LADC-6133)
Integral reactor tests in Project Rover, 19: 3720 (LA-DC-6576)
Magnetic analysis of ions involved in current leaking at 700 kv, 19: 2924 (LA-DC-6540)
Neutronic behavior of coupled Rover cores, 19: 3719 (LA-DC-6530)
Properties of bcc-hcp phase transitions of He-3 and He-4, 19: 2888 (LA-DC-6464)
Remote metallography of irradiated Pu, 19: 2858 (LADC-6393)
Second sound in resonant cavity in He II, 19: 3174 (LADC-6148)
Stabilizer capacity toward N_2O_4, 19: 3807 (LADC-6130)
Transient response of solid-state detectors, 19: 2604 (LA-DC-6500)

M

MARYLAND. UNIV., COLLEGE PARK.
Refractive index of FC-75, 19: 2892 (TID-21310)

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Physical basis of optical model, 19: 3239 (MIT-2098-67)
X-ray astronomy, 19: 2935 (MIT-2098-96)

MICHIGAN STATE UNIV., EAST LANSING.
Irradiation preservation of fish, fruits and vegetables, 19: 2066 (COO-1283-12)

MICHIGAN. UNIV., ANN ARBOR.
Cavitation damage tests of stressed specimens with Hg, 19: 2725 (NP-14437)
Irradiation preservation of fish, fruits and vegetables, 19: 2066 (COO-1283-12)

MIDWESTERN UNIVERSITIES RESEARCH ASSN., STOUGHTON, WIS.
Neutrino fluxes without focusing and with "ideal" focusing, 19: 2925 (MURA-698)
Suitability of 500-Mev FFAG synchrotron as injector for AGS and ZGS, 19: 2926 (MURA-701)

MOUND LAB., MIAMISBURG, OHIO.
Coincidence corrections in proportional counter. I., 19: 2605 (MLM-1197)

N

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND.
Two-dimensional flux and criticality calculations for Plum Brook reactor, 19: 3778 (NASA-TN-D-2210)

NATIONAL CARBON CO., PARMA, OHIO.
Advanced graphite materials, 19: 2359 (WADD-TR-61-72(Vol.X Suppl.))

NATIONAL LEAD CO. OF OHIO, CINCINNATI.

Blending of UF_4 by linear programming techniques, 19: 2204 (NLCO-935)
Comparison of methods for particle size analysis, 19: 2576 (NLCO-925)
Determination of C in U and Th metal, 19: 2215 (NLCO-928)
Neutron activation facility, 19: 2214 (NLCO-927)

NATIONAL RESEARCH COUNCIL. PREVENTION OF DETERIORATION CENTER.
Bibliography on superalloys and protective coatings, 19: 2728 (PDL-50140)

NAVAL RADIOLOGICAL DEFENSE LAB., SAN FRANCISCO.
Accumulation of lethal irradiation doses by exposure to x rays, 19: 2081 (USNRDL-TR-784)
Penetration of γ rays through slabs of Al and steel. III., 19: 3455 (USNRDL-TR-730)

NAVAL RESEARCH LAB., WASHINGTON, D. C.
Neutron embrittlement of reactor pressure vessel steels, 19: 2859 (NRL-6160)

NEW SOUTH WALES, AUSTRALIA. UNIV., KENSINGTON.
Irradiation of uracil in de-aerated aqueous solutions, 19: 2372 (NRS-22)

NEW YORK OPERATIONS OFFICE. HEALTH AND SAFETY LAB., AEC.
Reactor fission product releases, 19: 2545 (HASL-148)

NEW YORK. STATE UNIV. COLL. OF CERAMICS, ALFRED.
Prog. rpt. on stress-strain behavior of $SrZrO_3$, 9/15/63–9/15/64, 19: 2793 (AD-607173)

NORWAY. INSTITUTT FOR ATOMENERGI, KJELLER.
JEEP-II research reactor core in NORA, 19: 3780 (TID-21248)
Prog. rpt., 4–6/64, 19: 3806 (KR-79)
Progressive substitution experiments in UO_2 lattices moderated by D_2O/H_2O mixtures, 19: 3521 (TID-21238)

NORWAY. INSTITUTT FOR ATOMENERGI. OECD HALDEN REAKTOR PROSJEKT.
Central oxide temperature measurements at HBWR, 19: 3646 (HPR-35 (Vol.II)(Sect.13))
Conference on in-core instrumentation at HBWR, Oslo 6/64, 19: 3632 (HPR-35(Vol.I))
Conference on in-core instrumentation at HBWR, Oslo, 6/64, 19: 3642 (HPR-35(Vol.II))
Fission gas pressure measurement, 19: 3647 (HPR-35(Vol.II)(Sect.14))
Forced circulation boiling investigations in instrumented fuel assembly at HBWR, 19: 3637 (HPR-35(Vol.I)(Sect.5))
Fuel failure location in natural circulation BWRs, 19: 3649 (HPR-35 (Vol.II)(Sect.16))
Gamma thermometer development at HBWR, 19: 3639 (HPR-35(Vol.I) (Sect.7))
HBWR attitude on in-core instrumentation, 19: 3633 (HPR-35(Vol.I) (Sect.1))
HBWR turbine flow meters, 19: 3640 (HPR-35(Vol.I)(Sect.8))
Impedance void meter for HBWR, 19: 3641 (HPR-35(Vol.I)(Sect.9))
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ä	becomes	ae
ö		oe
ø		oe
ü		ue (except in transliterated Chinese names)

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SUBJECT INDEX

Main entries in this index are generally specific materials, things, and processes. These are followed by modifiers that describe the properties of, and processes applied to, the main entries.

The number preceding the colon is the *NSA* volume number, and the number following is the abstract number. The designation (R) following the abstract number indicates that the abstract is of a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. References to report numbers, where appropriate, are included after the abstract number of the citation. Published literature (journal article or book) is indentifiable by the absence of a report number.

The user should bear in mind that the ideas presented in the original literature, rather than key words, have been indexed. The indexers have tried to select what seemed the most probable and logical place to look for typical information. Since it is not possible to anticipate where a user would look for information, numerous cross references are included to assist him in his search.

Experience in using an index of this type will be the best guide in obtaining the desired information, and a consideration of synonymous or closely related terms will prove valuable.

Information must be so indexed as to be of the greatest use to the greatest number of users. This requires that a topic be indexed to headings that most specifically describe it and not ordinarily to the headings that describe its ultimate use, nor to the general class headings that include the specific headings. For example, information on the treatment of thyroid disease with I-131 would be indexed under Thyroid Diseases and under Iodine Isotopes I-131, but not necessarily under Radiotherapy. A study of the effects of x radiation on hair would be indexed under both X Radiation and Hair.

The broad, general class headings are used only for general information or for comprehensive reports or articles.

Subject Heading Styles

Generally, the direct form of subject entry is used rather than inverted headings or, in some cases, subheadings; e.g., Amino Acids rather than Acids, amino; Helium Isotopes He-4 rather than Helium—isotopes He-4 or Helium—He-4 isotopes. Note, however, that in some cases modifying terms are used parenthetically in preference to a more direct type of entry which would result in the scattering of information. Organic compounds, however, are usually entered in the index in the inverted form so that substituted compounds can be listed near the parent compound; e.g., Benzene, Bromo- rather than Bromobenzene. In general, the style of nomenclature used is that of *Chemical Abstracts*, except that some items listed in that publication as subheadings are elevated to form part of the main heading; e.g., Butyric Acid, Methyl Ester rather than Butyric Acid—methyl ester.

Alphabetization

Main headings are arranged according to the widely accepted word-by-word alphabetic system. A parenthetic qualifier following a main heading is disregarded in alphabetizing unless there are two or more headings identical except for the parenthetic qualifier, in which case the qualifier determines the order. Headings involving Greek letters are arranged as if the names of the letters were spelled out, e.g., Mesons (π), Mesons (ζ).

Nomenclature of Inorganic Compounds

Inorganic compounds are indexed in the direct form, listing cations in the order of increasing valence in the case of polycationic salts of varying valence and in alphabetic order for polycationic salts in which all cations have the same valence; e.g., Sodium Aluminum Silicates and Potassium Sodium Sulfates.

Multicomponent Systems

Multicomponent alloys, except well-known trade names are indexed under each element in the alloy.

Example: Aluminum–Chromium Alloys are indexed

ALUMINUM ALLOYS
Al–Cr ...
CHROMIUM ALLOYS
Al–Cr ...

Well-known alloys such as Hastelloy are indexed directly. Cross references appear in the index cumulations. Multicomponent systems of elements are indexed similarly.

Example: Silicon–Tungsten Systems are indexed

SILICON SYSTEMS
Si–W ...
TUNGSTEN SYSTEMS
Si–W ...

Multicomponent systems of compounds are similarly indexed under the compound.

Physical States of Materials

Specification of the physical state of the material, if other than normal, is included in the modifying phrase.

Modifying Phrases (Subheadings)

Whenever it appears that such information would be useful, descriptive phrases (modifiers), rather than ordinary subheadings, are used under the main headings to give a better indication of the material covered in an abstract. Such phrases are written so that the idea considered most important is presented first. However, when using this index, the reader is advised to scan all modifiers under a main heading to determine whether any abstracts in addition to the most obvious should be consulted for the desired information. Many of the modifiers are designed to be read in inverted order or to be read with the main heading inserted at the position of the comma in order to obtain a meaningful phrase; e.g., Uranium—allotropic transformation temperatures of, effect of cooling rate on is read "effect of cooling rate on allotropic transformation temperatures of uranium." In many cases, the prepositions have been omitted from such phrases provided no ambiguity results from the omission.

For entries concerned with physics, if the modifier does not indicate whether the reference is experimental or theoretical, a symbol E or T or E/T is given.

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Cosmic Rays, Jaipur, Dec. 1963, 19: 3005
High-temperature Technology, Pacific Grove, Calif., Sept. 8-11, 1963, 19: 2741
In-Core Instrumentation at HBWR, Oslo, Norway, June 15 to 19, 1964, 19: 3642 (HPR-35(Vol.II))
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Instrumentation in Plants for Chemical Reprocessing of Irradiated Fuels, Colloquy on, Paris, Nov. 22 and 23, 1963, 19: 2436 (NP-14343)
Limnology, International Association of Theoretical and Applied, Madison, Wisconsin, August 20 to 25, 1962, Vol. XV, 19: 1993
Nuclear Applications to the Wood, Paper, and Pulp Industries Conference, Pullman, Washington, April 23 to 24, 1964, 19: 2684
Nuclear Energy Utilization in Shipbuilding and Navigation, Third International Reactor Session of Research Society for Promotion of, Hamburg, May 27 to 30, 1964, 19: 3744
Powder Metallurgy Technical Conference, Nineteenth Annual, Detroit, Mich., April 29 to May 1, 1963, 19: 2735
Powder Metallurgy, Chicago, April 27-29, 1964, Vol. 20, 19: 2736
Radioactivity and Water Protection, Symposium on, Karlsruhe, Germany, June 26 to 28, 1963, 19: 2535
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606973	19-2359	See WADD-TR-61-72(Vol.X Suppl.)
607173	19-2793	$3.00(OTS)
607274	19-2794	See APL-TDR-64-116(Pt.I)
AE–	**(Non-AEC)**	
155	19-3771	Dep.(mn)
157	19-3450	Dep.(mn)
158	19-3229	Dep.(mn)
160	19-3230	Dep.(mn)
AECL–	**(Canadian)**	
1930	19-3610	Dep.; $2.00(AECL)
1999	19-2763	Dep.; $1.00(AECL)
2041	19-2572	See ELI-85
2061	19-2568	Dep.; $0.50(AECL)
2071	19-2602	See CRGP-1182
2076	19-2209	See CRDC-1141
2083	19-3189	See CRRP-1201
2102	19-3587	Dep.; $0.50(AECL)
AED-C–	**(German)**	
06-10	19-2598	Dep.(mn)
AEEW-M–	**(British)**	
441	19-3503	Dep.; $1.20(BIS) 6s. (HMSO)
AEEW-R–	**(British)**	
356	19-2511	Dep.; $3.20(BIS); 16s. 0d. (HMSO)
377	19-3451	Dep.; $0.80(BIS); 4s. (HMSO)
AERE-M–	**(British)**	
1429	19-2569	Dep.; $0.70(BIS); 3s. 6d. (HMSO)
AERE-NP–	**(British)**	
GEN-36	19-3293	Nucl. Phys., 61: 457-64(1965)
AERE-R–	**(British)**	
4630	19-2512	Dep.; (BIS)
4700	19-2715	Dep.; $0.30(BIS); 1s. 9d. (HMSO)
AFOSR–	**(Misc.)**	
64-0039	19-2266	$6.00(OTS)
ANL–		
5772	19-3231	Dep.; $1.00(cy), 1(mn) OTS
6907	19-2267	Dep.; $3.00(cy), 1(mn) OTS
6916	19-2268	Dep.; $2.00(OTS)
6918	19-2430	Dep.; $1.00(cy), 1(mn) OTS
ANL-Trans–		
116	19-2277	Dep.(mn); $1.00(cy), 1(mn) OTS; $1.10(fs), $0.80(mf) JCL
117	19-2278	Dep.(mn); $1.00(cy), 1(mn) OTS; $1.10(fs), $0.80(mf) JCL
121	19-2082	Dep.(mn); $1.10(fs), $0.80(mf) JCL
APL-TDR–	**(Non-AEC)**	
64-116(Pt.I)	19-2794	$3.00(OTS)
ASTRA-G–	**(Non-AEC)**	
39.2	19-3611	
41.3	19-3714	
AWRE-O–	**(British)**	
52/64	19-3504	Dep.(mn)
57/64	19-3015	Dep.(mn)
BM-RI–	**(Misc.)**	
6553	19-2795	Free(Bureau of Mines)
BMI–	**(Misc.)**	
1681(Del.)	19-2716	Dep.; $2.00(cy), 1(mn) OTS
BMI-X–		
315	19-2744	Dep.(mn); $1.00(cy), 1(mn) OTS
10100	19-2717	Dep.(mn); $1.00(cy), 1(mn) OTS
BNL–		
883	19-3804	Dep.; $3.00(OTS)
3138	19-2693	Dep.(mn); $1.00(cy), 1(mn) OTS
7444	19-2599	Dep.(mn); $2.00(cy), 1(mn) OTS
7447	19-2465	Dep.(mn); $1.00(cy), 1(mn) OTS
7463	19-2000	Dep.(mn); $1.00(cy), 1(mn) OTS
7546	19-2570	Dep.(mn); $1.00(cy), 1(mn) OTS
7596	19-2060	Dep.(mn); $1.00(cy), 1(mn) OTS
7613	19-3805	Dep.(mn); $1.00(cy), 1(mn) OTS
7823	19-3505	Dep.(mn); $1.00(cy), 1(mn) OTS; Gmelin, AED-CONF-64-081-29
8105	19-3345	Phys. Rev., 136: B1359-63(1964)
8163	19-2333	Phys. Rev., 136: A1641-7(1964)
8174	19-3351	Phys. Rev., 136: B913-15(1964)
8175	19-3352	Phys. Rev., 136: B916-19(1964)
8191	19-3069	Phys. Rev., 136: B1157-9(1964)
8196	19-3338	Phys. Rev., 136: B1285-8(1964)
8221	19-2201	Dep.(mn); $1.00(cy), 1(mn) OTS
8255	19-2673	Trans. Am. Nucl. Soc., 7: 345(1964)
8258	19-2084	Acta Iberica Radiol.-Cancerol., 19: 247-54([1964])
8363	19-3080	Phys. Rev., 136: B1364-81(1964)
8432	19-2707	Dep.(mn); $1.00(cy), 1(mn) OTS
8451	19-2061	Dep.(mn); $2.00(cy), 1(mn) OTS
8462	19-2062	Dep.(mn); $1.00(cy), 1(mn) OTS
8469	19-2063	Dep.(mn); $1.00(cy), 1(mn) OTS
8471	19-2001	Dep.(mn); $2.00(cy), 1(mn) OTS
8486	19-2064	Dep.(mn); $1.00(cy), 1(mn) OTS
8491	19-2065	Dep.(mn); $1.00(cy), 1(mn) OTS
8496	19-2920	Dep.(mn); $1.00(cy), 1(mn) OTS
8514	19-2269	$1.00(cy), 1(mn) OTS
8519	19-2600	Dep.(mn); $1.00(cy), 1(mn) OTS
8527	19-3232	Dep.(mn); $1.00(cy), 1(mn) OTS
8533	19-3112	Dep.(mn); $1.00(cy), 1(mn) OTS
8537	19-2370	$1.00(cy), 1(mn) OTS
8544	19-2921	Dep.(mn); $1.00(cy), 1(mn) OTS
8556	19-2922	Dep.(mn); $1.00(cy), 1(mn) OTS
8560	19-2601	Dep.(mn); $1.00(cy), 1(mn) OTS
BSD-TDR–	**(Misc.)**	
64-20	19-2887	$2.00(OTS)
64-107	19-3016	$2.00(OTS)
CAPE–		
1127	19-2586	EM
1152	19-2587	EM
1178	19-2654	EM
CAR–		
882-1	19-3113	Dep.(mn); $1.00(cy), 1(mn) OTS
CEA-R–	**(French)**	
2229	19-3506	Dep.(mn)
2230	19-3507	Dep.(mn)
2345	19-3612	Dep.(mn)
2377	19-3772	Dep.(mn)
2441	19-2207	Dep.(mn)
2450	19-3613	Dep.(mn)
2454	19-3508	Dep.(mn)
2465	19-3614	Dep.(mn)

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2472	19-3509	Dep.(mn)
2473	19-3510	Dep.(mn)
2477	19-3511	Dep.(mn)
2480	19-3615	Dep.(mn)
2487	19-3512	Dep.(mn)
2500	19-3616	Dep.(mn)
2501	19-3617	Dep.(mn)
2504	19-3618	Dep.(mn)
2532	19-3773	Dep.(mn)
2536	19-3774	Dep.(mn)
2589	19-3775	Dep.
CEA-TP–	**(French)**	
1593	19-2718	Dep.(mn)
CEA-tr–	**(French)**	
R-1764	19-2279	Dep.(mn); $1.10(fs), $0.80(mf) JCL
CEC–	**(Italian)**	
94	19-3456	For translation see ORNL-tr-349
CERN–	**(European Organization for Nuclear Research)**	
64-45	19-2923	Dep.(mn)
64-46	19-2571	Dep.(mn)
CLM-P–	**(British)**	
57	19-3425	Nature, 203: 1321-2(1964)
CLOR–	**(Polish)**	
28	19-2208	Dep.
CONF-14–	**(American Chemical Society 144th National Meeting, Los Angeles, Mar. 1963)**	
44	19-2358	See EUR-1647.e
CONF-151–	**(19th International Union of Pure and Applied Chemistry Congress, London)**	
6	19-2271	See EUR-1908.e
CONF-157–	**(American Chemical Society Northwest Regional Meeting, Bellingham, Wash., June 1963)**	
8	19-2371	See HW-SA-3066
CONF-188–	**(Proceedings of the 1st Inter-American Conference on Radiochemistry, Montevideo, July 1963)**	
2	19-2676	Dep.(mn)
CONF-337–	**(International Conference on Radioactive Pollution of Gaseous Media, Saclay, France, Nov. 1963)**	
21	19-2886	ORINS
CONF-446–	**(American Nuclear Society 10th Annual Meeting, Philadelphia, June 1964)**	
44	19-3505	See BNL-7823
CONF-457–	**(International Atomic Energy Agency Panel Meeting, Vienna, Mar. 1964)**	
2	19-3452	See JAERI-4029
CONF-471–	**(American Physical Society 5th Annual Meeting, San Diego, Calif., Nov. 1963)**	
39	19-3399	See UCRL-7660-T
43	19-3396	See MATT-222
CONF-512–	**(American Society for Testing and Materials 67th Annual Meeting, Chicago, June 1964)**	
10	19-2859	See NRL-6160
CONF-515–	**(2nd Annual National Electronics Packaging and Production Conference, New York, June 1964)**	
2	19-2528	ORINS. Gmelin, AED-CONF-64-090-1
CONF-522–	**(Annual Meeting of the Aerospace Medical Association, Miami, Fla., May 1964)**	
2	19-2162	ORINS. Gmelin, AED-CONF-64-061-1
CONF-551–	**(Technical Meeting on the Use of Induced Mutations in Plant Breeding Programs, Rome, May-June 1964)**	
6	19-2065	See BNL-8491
CONF-624	**19-2684**	**(Symposium on Nuclear Applications to the Wood, Paper and Pulp Industries, Pullman, Wash., Apr. 1964)**
CONF-637–	**(Institute of Electrical and Electronics Engineers Region 3 Annual Meeting and Technical Conference, Clearwater, Fla., May 1964)**	
8	19-2668	ORINS. Gmelin, AED-CONF-64-057-16
10	19-2921	See BNL-8544
CONF-639–	**(24th Annual Meeting of the Institute of Food Technologists, Washington, D. C., May 1964)**	
3	19-2163	ORINS. Gmelin, AED-CONF-64-086-1
CONF-642–	**(Health Physics Society, Cincinnati, June 1964)**	
5	19-2566	ORINS. Gmelin, AED-CONF-64-082-15
6	19-2653	ORINS. Gmelin, AED-CONF-64-082-7
CONF-651–	**(9th International Conference on Low Temperature Physics, Columbus, Ohio, Aug. 31–Sept. 4, 1964)**	
12	19-2888	See LA-DC-6464
CONF-652–	**(American Industrial Hygiene Association Pacific Northwest Section Meeting, Richland, Wash., Aug 1964)**	
1	19-2552	See HW-SA-3676
CONF-654–	**(American Nuclear Society Meeting, San Francisco, Nov. 30–Dec. 3, 1964)**	
3	19-2433	See HW-SA-3655
7	19-2373	See ORNL-P-661
9	19-2727	See ORNL-P-166
10	19-3588	See GAMD-5004
11	19-2201	See BNL-8221
12	19-2766	See ORNL-P-128
14	19-3013	See LA-DC-6537
15	19-3719	See LA-DC-6530
16	19-3240	See ORNL-P-169
17	19-2858	See LADC-6393
20	19-3520	See RPI-328-9
21	19-2765	See HW-SA-3486
CONF-668–	**(Electron Microscope Society of America 22nd Annual Meeting, Detroit, Mich., Oct. 1964)**	
2	19-2578	See RFP-389
CONF-669–	**(Conference on Particle Physics, Boulder, Colo., June–July 1964)**	
2	19-3030	See UCRL-11729
3	19-3031	See UCRL-11730
CONF-679–	**(International Conference on the Physics of Semiconductors, Paris, July 1964)**	
2	19-2665	See SC-R-64-1324
CONF-682–	**(Gordon Conference on Nuclear Structure Physics, New London, New Hampshire, Aug. 31–Sept. 4, 1964)**	
1	19-3239	See MIT-2098-67
CONF-687–	**(Meeting of the Latin-American Council for Cosmic Radiation and Space Physics, Tucuman and Buenos Aires, Argentina, Aug. 1964)**	
2	19-3147	See D1-82-0372
CONF-710–	**(2nd International Symposium on Materials, Berkeley, Calif., June 15–18, 1964)**	
4	19-2731	See UCRL-11470
CONF-717–	**(CNRS Meeting on Graft of Allogenic Hematopoietic Cells, Paris, Sept. 7–9, 1964)**	
3	19-2079	See ORNL-P-656
CONF-720–	**(2nd Symposium on Protection Against Radiation Hazards in Space, Gatlinburg, Oct. 1964)**	
2	19-2184	See LA-DC-6681
CONF-721–	**(8th Conference on Analytical Chemistry in Nuclear Technology, Gatlinburg, Tenn., Oct. 6–8, 1964)**	
5	19-2606	See RFP-439

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CONF-734–	(Symposium on Genes and Chromosomes Structure and Function, Buenos Aires, Nov.–Dec. 1964)	
2	19-2078	See ORNL-P-652
3	19-3809	See ORNL-P-654
CONF-742–	(15th CITCE Meeting (Internat'l Comm. on Thermodynamics and Electrochemical Kinetics), London, England, Sept. 20–26, 1964)	
2	19-2273	See IA-941
CONF-754–	(International Business Machines Medical Symposium, Poughkeepsie and Upton, N. Y., Oct. 9, 1964)	
1	19-2707	See BNL-8432
2	19-2064	See BNL-8486
3	19-2062	See BNL-8462
CONF-764–	(Thermal Conductivity Conference, San Francisco, Oct. 15, 1964)	
6	19-2796	Dep.(mn); $1.00(cy), 1(mn) OTS
9	19-2797	Dep.(mn); $1.00(cy), 1(mn) OTS
10	19-2798	Dep.(mn); $1.00(cy), 1(mn) OTS
CONF-765–	(2nd Conference on Radioactive Fallout from Nuclear Weapons Tests, Germantown, Md., Nov. 3–6, 1964)	
4	19-2532	See UCRL-12124-T
CONF-768–	(International Conference on Aerospace Electro-Technology, Phoenix, Arizona, April 1964)	
2	19-2667	ORINS
CONF-770–	(Proceedings of the Clay Mineral Society, Madison, Wis., Oct. 5–9, 1964)	
2	19-2807	See UCRL-11671
CONF-773–	(Symposium on Chemical Effects Associated with Nuclear Reactions and Radioactive Transformation, Vienna, Dec. 1964)	
3	19-2370	See BNL-8537
CONF-776–	(National Electronics Conference, Chicago, Oct. 1964)	
1	19-2711	See SC-R-64-1355
2	19-2548	See UCRL-7791(Summary)
CONF-777–	(Symposium on Materials for Cooling Reactors with Sodium, New York, Nov. 1963)	
1	19-2718	See CEA-TP-1593
CONF-778–	(Metals/Materials Congress, Philadelphia, Oct. 1964)	
1	19-2853	ORINS
2	19-2790	ORINS
3	19-2745	Dep.(mn); $2.00(cy), 1(mn) OTS
CONF-781–	(Solvay Conference, Brussels, May 1964)	
1	19-2935	See MIT-2098-96
CONF-782–	(Symposium on the Structure, Chemistry, and Functions of Chromosomes, Istanbul, July 8–26, 1963)	
1	19-1988	See EUR-1836.e
CONF-784–	(Nondestructive Testing Symposium, Argonne, Ill., July 22–24, 1964)	
1	19-2526	See HW-SA-3578
CONF-785–	(7th Symposium on Neuroradiologicum, New York, Sept. 20–25, 1964)	
1	19-2061	See BNL-8451
CONF-786–	(Symposium on Use of Radioautography in Investigating Protein Synthesis, Montreal, Sept. 8–10, 1964)	
1	19-2001	See BNL-8471
CONF-787–	(5th International Conference on Nuclear Photography, Geneva, Sept. 15–18, 1964)	
2	19-3029	See UCRL-11518
CONF-788–	(International Conference on Magnetism, Nottingham, England, Sept. 7–11, 1964)	
1	19-2269	See BNL-8514
CONF-790–	(14th Annual Analytical and Physical Testing Symposium, Cincinnati, Oct. 15–16, 1964)	
1	19-2576	See NLCO-925
2	19-2214	See NLCO-927
3	19-2215	See NLCO-928
CONF-791–	(Study Group on Research Reactor Experimental Techniques, Bucharest, Oct. 26–31, 1964)	
1	19-3779	See ORNL-P-614
CONF-792–	(American Ceramic Society Meeting, San Francisco, Oct. 28–30, 1964)	
1	19-2860	See ORNL-P-631
CONF-793–	(Electron Devices Meeting, Washington, D. C., Oct. 29–31, 1964)	
1	19-2927	See SLAC-PUB-56
CONF-795–	(International Symposium on Insulation of High Voltage in Vacuum, Cambridge, Oct. 19–21, 1964)	
1	19-2920	See BNL-8496
2	19-2924	See LA-DC-6540
CONF-796–	(3rd Eastern Theoretical Physics Conference, College Park, Md., Oct. 30–31, 1964)	
1	19-3112	See BNL-8533
2	19-3113	See CAR-882-1
CONF-797–	(American Society of Mechanical Engineers, Albuquerque, N. Mex., Oct. 16, 1964)	
1	19-3721	See LA-DC-6652
2	19-3720	See LA-DC-6576
3	19-2471	See SC-DC-64-1591
CONF-798–	(Annual AEC and Contractor Health Protection Meeting, Los Angeles, Oct. 13–16, 1964)	
1	19-2183	See HW-SA-3730
CONF-799–	(11th Annual Nuclear Science Symposium, Philadelphia, Oct. 28–30, 1964)	
1	19-2600	See BNL-8519
3	19-2604	See LA-DC-6500
CONF-800–	(6th Japan Conference on Radioisotopes, Tokyo, Nov. 16–19, 1964)	
1	19-2191	See ORNL-P-658
2	19-2678	See ORNL-P-657
CONF-801–	(Panel on the Molecular Basis of Radiosensitivity, Vienna, Nov. 16–20, 1964)	
1	19-2063	See BNL-8469
CONF-803–	(International Symposium on the Dosimetry of Irradiations from External Sources, Paris, Nov. 23–27, 1964)	
1	19-2608	See UCRL-12151
4	19-2601	See BNL-8560
CONF-805–	(European-American Nuclear Data Committee Meeting, Brussels, Jan. 18–22, 1965)	
3	19-2219	See ORNL-P-636
4	19-2218	See ORNL-P-635
CONF-806–	(3rd European Regional Conference on Electron Microscopy, Prague, Aug. 26–Sept. 3, 1964)	
1	19-2806	See UCRL-11239
CONF-807–	(Symposium on Use of Isotopes in Hematology, Freiburg, i. B., Mar. 1–3, 1962)	
1	19-2000	See BNL-7463
CONF-809–	(American Nuclear Society Winter Meeting, Washington, D. C., Dec. 10, 1956)	
1	19-2693	See BNL-3138
CONF-811–	(9th Yugoslavian Summer Meeting of Physicists, Hercegnovi, Yugoslavia, July 9–31, 1964)	
1	19-3232	See BNL-8527
CONF-812–	(Society for Applied Spectroscopy 3rd National Meeting, Cleveland, Sept. 28–Oct. 2, 1964)	

Report No.	Abstract No.	Availability
1	19-2577	See ORNL-P-87
CONF-815–	**(1964 Fall Meeting, Western States Section, The Combustion Institute, Salt Lake City, Oct. 26–27, 1964)**	
1	19-2275	See SC-DC-64-1559
CONF-816–	**(Midwest POOL Meeting, Chicago, Nov. 10–11, 1964)**	
1	19-2204	See NLCO-935
COO–		
623-101	19-2799	Dep.(mn); $2.00(cy), 1(mn) OTS
623-103	19-2270	Dep.(mn); $2.00(cy), 1(mn) OTS
1283-12	19-2066	Dep.; $3.00(cy), 2(mn) OTS
CRDC–	**(Canadian)**	
1141	19-2209	Dep.; $0.50(AECL)
CRGP–	**(Canadian)**	
1182	19-2602	Dep.; $0.50(AECL)
CRRP–	**(Canadian)**	
1201	19-3189	Dep.; $1.50(AECL)
D–	**(Misc.)**	
1-82-0372	19-3147	
DMIC-Memo–	**(Non-AEC)**	
176	19-2719	$0.75(OTS)
DP–		
199	19-2764	Dep.(mn); $2.00(cy), 1(mn) OTS
DUBNA REPORTS	**(Russian)**	
See JINR (Russian)		
EGG–		
1183-1071	19-3715	Dep.; $2.00(cy), 1(mn) OTS
ELI–	**(Canadian)**	
85	19-2572	Dep.; $2.00(AECL)
EUR–	**(European Atomic Energy Community)**	
1642.f	19-2718	See CEA-TP-1593
1647.e	19-2358	Dep.(mn)
1807.f	19-3613	See CEA-R-2450
1836.e	19-1988	Dep.(mn)
1893.i	19-2067	Dep.(mn)
1895.d	19-2202	Dep.(mn)
1908.e	19-2271	Dep.(mn)
1912.i	19-2203	Dep.(mn)
1914.e	19-3513	Dep.(mn)
2101.e	19-2573	Dep.(mn)
EURAEC–		
1232	19-2717	See BMI-X-10100
F–	**(Misc.)**	
B1979-2	19-2803	See NYO-2994-2
FTDM–	**(Non-AEC)**	
3053	19-2855	$0.50(OTS)
FZK–	**(Non-AEC)**	
154	19-3716	
156	19-3717	
184-1	19-3718	
GA–	**(Misc.)**	
3561	19-3620	Dep.(mn); $3.00(cy), 1(mn) OTS
3830	19-3621	Dep.(mn); $3.00(cy), 2(mn) OTS
GAMD–	**(Misc.)**	
4131	19-3514	Dep.(mn); $1.00(cy), 1(mn) OTS
4447	19-3622	$4.00(cy), 3(mn) OTS
4592	19-3623	Dep.(mn); $1.00(cy), 1(mn) OTS
5004	19-3588	Dep.(mn); $2.00(cy), 1(mn) OTS
5049(Rev.)	19-3624	Dep.(mn); $2.00(cy), 1(mn) OTS
GEAP–	**(Misc.)**	
4476(Vol.I)	19-3625	Dep.(mn); $3.00(cy), 2(mn) OTS
4476(Vol.II)	19-3626	Dep.(mn); $4.00(cy), 3(mn) OTS
4476(Vol.III)	19-3627	Dep.(mn); $6.00(cy), 4(mn) OTS
4598	19-3628	$3.00(cy), 2(mn) OTS
4602	19-2210	Dep.(mn); $3.00(cy), 2(mn) OTS
4620	19-3629	Dep.(mn); $3.00(cy), 2(mn) OTS
GEMP–	**(Misc.)**	
40A	19-2800	Dep.; $2.00(cy), 1(mn) OTS
HASL–		
148	19-2545	Dep.; $3.00(cy), 1(mn) OTS
HPR–	**(Norwegian)**	
20	19-3630	Dep.(mn)
34	19-3631	Dep.(mn)
35(Vol.I)	19-3632	Dep.(mn)
35(Vol.II)	19-3642	Dep.(mn)
HW–		
59288	19-3776	$1.00(cy), 1(mn) OTS
73341	19-2554	Dep.(mn); $1.00(cy), 1(mn) OTS
77023	19-2431	Dep.(mn); $2.00(cy), 1(mn) OTS
77345	19-2555	Dep.(mn); $1.00(cy), 1(mn) OTS
79559	19-2856	Dep.; $3.00(cy), 2(mn) OTS
79977	19-3651	Dep.; $3.00(cy), 2(mn) OTS
80117	19-3710	Dep.(mn); $1.00(cy), 1(mn) OTS
80178	19-2720	Dep.(mn); $1.00(cy), 1(mn) OTS
80876	19-2432	Dep.(mn); $1.00(cy), 1(mn) OTS
81973	19-2475	Dep.(mn); $2.00(cy), 2(mn) OTS
82043	19-3589	$2.00(cy), 1(mn) OTS
82397	19-3515	Dep.(mn); $1.00(cy), 1(mn) OTS
82624	19-2211	Dep.(mn); $1.00(cy), 1(mn) OTS
83296	19-3516	$1.00(cy), 1(mn) OTS
HW-SA–		
2333(Rev.)	19-2746	Dep.(mn); $1.00(cy), 1(mn) OTS
3066	19-2371	Dep.(mn); $1.00(cy), 1(mn) OTS
3129	19-2857	Dep.(mn); $1.00(cy), 1(mn) OTS
3147	19-2540	Limnol. Oceanog., 9: 540-5(1964)
3199	19-2272	Dep.(mn); $2.00(cy), 1(mn) OTS
3241	19-2801	Dep.(mn); $1.00(cy), 1(mn) OTS
3261	19-2466	Dep.(mn); $1.00(cy), 1(mn) OTS
3314	19-2011	Am. J. Physiol., 207: 561-6(1964)
3486	19-2765	Dep.(mn); $1.00(cy), 1(mn) OTS
3535	19-1997	Nature, 204: 238-40(1964)
3578	19-2526	Dep.(mn); $2.00(cy), 1(mn) OTS
3655	19-2433	Dep.(mn); $1.00(cy), 1(mn) OTS
3676	19-2552	Dep.(mn); $1.00(cy), 1(mn) OTS
3730	19-2183	Dep.(mn); $1.00(cy), 1(mn) OTS
HWS–		
5991	19-2607	See TID-21291
IA–	**(Non-AEC)**	
941	19-2273	Dep.(mn)
980	19-3476	Dep.(mn)
IDO–		
16990	19-3517	Dep.; $4.00(cy), 3(mn) OTS
17009	19-3777	Dep.; $2.00(cy), 1(mn) OTS
IEA–	**(Brazilian)**	
72	19-2212	Dep.(mn)
IS–		
743	19-2960	Dep.; $4.00(cy), 3(mn) OTS
891	19-2820	J. Less-Common Metals, 7: 373-82(1964)
939	19-2750	J. Less-Common Metals, 7: 433-40(1964)
IS-Trans–		
7	19-2280	Dep.(mn); $1.10(fs), $0.80(mf) JCL
JAERI–	**(Japanese)**	
1061	19-3652	Dep.(mn)
1065	19-2553	
4028	19-2213	Dep.(mn)
4029	19-3452	Dep.(mn)
4030	19-2721	

Report No.	Abstract No.	Availability
JINR–	**(Russian)**	
D-1818	19-3233	Dep.(mn)
P-1744	19-3234	Dep.(mn)
P-1746	19-3024	Dep.(mn)
P-1761	19-3235	Dep.(mn)
P-1763	19-3025	Dep.(mn)
P-1765	19-3236	Dep.(mn)
P-1767	19-3237	Dep.(mn)
P-1768	19-3026	Dep.(mn)
P-1771	19-3238	Dep.(mn)
P-1782	19-3027	Dep.(mn)
JPLAI-LS–	**(Non-AEC)**	
587	19-2467	
JPRS–	**(Non-AEC)**	
27049	19-3816	$3.00(OTS)
27239	19-2083	$1.00(OTS)
K–		
1618	19-2603	Dep.; $5.00(cy), 6(mn) OTS
K-OA–		
899	19-2694	Dep.(mn); $1.00(cy), 1(mn) OTS
1150	19-2695	Dep.(mn); $1.00(cy), 1(mn) OTS
1173	19-2696	Dep.(mn); $1.00(cy), 1(mn) OTS
1195	19-2697	Dep.(mn); $1.00(cy), 1(mn) OTS
KR–	**(Norwegian)**	
69	19-3780	See TID-21248
79	19-3806	Dep.(mn)
90	19-3521	See TID-21238
LA-DC–		
6464	19-2888	$1.00(cy), 1(mn) OTS
6500	19-2604	Dep.(mn); $1.00(cy), 1(mn) OTS
6513	19-2310	J. Chem. Phys., 41: 3407-11(1964)
6517	19-2309	J. Chem. Phys., 41: 3405-7(1964)
6518	19-3337	Phys. Rev., 136: B1279-85(1964)
6530	19-3719	Dep.(mn); $1.00(cy), 1(mn) OTS
6535	19-2458	Trans. Am. Nucl. Soc., 7: 397-8(1964)
6537	19-3013	Dep.(mn); $1.00(cy), 1(mn) OTS
6538	19-2782	Trans. Am. Nucl. Soc., 7: 426-7(1964)
6540	19-2924	Dep.(mn); $1.00(cy), 1(mn) OTS
6576	19-3720	$1.00(cy), 1(mn) OTS
6652	19-3721	Dep.(mn); $1.00(cy), 1(mn) OTS
6681	19-2184	Dep.(mn); $1.00(cy), 1(mn) OTS
LADC–		
6130	19-3807	Dep.(mn); $1.00(cy), 1(mn) OTS
6133	19-2708	Dep.(mn); $2.00(cy), 1(mn) OTS
6146	19-2961	Dep.(mn); $2.00(cy), 1(mn) OTS
6148	19-3174	Dep.(mn); $1.00(cy), 1(mn) OTS
6164	19-3808	Dep.(mn); $1.00(cy), 1(mn) OTS
6338	19-2315	J. Less-Common Metals, 7: 330-5(1964)
6358	19-2818	J. Less-Common Metals, 7: 341-6(1964)
6393	19-2858	Dep.(mn); $1.00(cy), 1(mn) OTS
6454	19-2821	J. Less-Common Metals, 7: 383-92(1964)
LFEN-NI–	**(Portuguese)**	
15	19-2434	Dep.
17	19-2185	Dep.(mn)
MATT–		
222	19-3396	Dep.(mn); $1.00(cy), 1(mn) OTS; Gmelin, AED-CONF-63-268-44
285	19-3397	Dep.; $2.00(cy), 1(mn) OTS
MIT–	**(Misc.)**	
2098-46	19-3076	Phys. Rev., 136: B1196-1206(1964)
2098-59p	19-3097	Phys. Rev. Letters, 13: 558-62(1964)
2098-58	19-3322	Nucl. Phys., 62: 254-66(1965)
2098-67	19-3239	Dep.(mn); $1.00(cy), 1(mn) OTS
2098-96	19-2935	Dep.(mn); $1.00(cy), 1(mn) OTS
ML-TDR–	**(Non-AEC)**	
64-55	19-2722	$2.50(OTS)
MLM–		
1197	19-2605	Dep.; $1.00(cy), 1(mn) OTS
1223]	19-2583	J. Vacuum Sci. Technol., 1: 51-3(1964)
MURA–	**(Misc.)**	
698	19-2925	Dep.; $1.00(cy), 1(mn) OTS
701	19-2926	Dep.; $1.00(cy), 1(mn) OTS
NAA-SR–		
9647	19-3722	Dep.; $2.00(cy), 1(mn) OTS
9779	19-3723	Dep.; $3.00(cy), 2(mn) OTS
NAA-SR-Memo–		
9327(Add.)	19-3453	Dep.(mn); $1.00(cy), 1(mn) OTS
9841	19-2574	Dep.(mn); $2.00(cy), 1(mn) OTS
9883	19-2575	Dep.(mn); $2.00(cy), 1(mn) OTS
9891	19-3190	Dep.(mn); $4.00(cy), 3(mn) OTS
9920	19-2435	Dep.(mn); $1.00(cy), 1(mn) OTS
10165	19-3724	Dep.(mn); $1.00(cy), 1(mn) OTS
10169	19-3725	Dep.(mn); $2.00(cy), 1(mn) OTS
10175	19-2468	Dep.(mn); $1.00(cy), 1(mn) OTS
10191	19-2723	Dep.(mn); $1.00(cy), 1(mn) OTS
10209	19-2724	Dep.(mn); $1.00(cy), 1(mn) OTS
10239	19-2513	Dep.(mn); $2.00(cy), 1(mn) OTS
NASA-CR–	**(Misc.)**	
104	19-3398	$1.50(OTS)
108	19-3175	$2.75(OTS)
54159	19-3713	See 64SD892
54178	19-2514	See PWA-2315
54179	19-3729	See PWA-2342
NASA-TN–	**(Misc.)**	
D-2210	19-3778	$1.25(OTS)
NDA-Memo–	**(Misc.)**	
2014-159	19-3653	
NIRL-R–	**(British)**	
72	19-2709	Dep.(mn); $0.70(BIS); 3s. 6d. (HMSO)
NLCO–		
925	19-2576	Dep.(mn); $1.00(cy), 1(mn) OTS
927	19-2214	Dep.(mn); $1.00(cy), 1(mn) OTS
928	19-2215	Dep.(mn); $1.00(cy), 1(mn) OTS
935	19-2204	Dep.(mn); $1.00(cy), 1(mn) OTS
NORA–	**(Norwegian)**	
7	19-3780	See TID-21248
21	19-3521	See TID-21238
NP–	**(AEC File No. for Non-AEC Reports)**	
14284	19-2531	Dep.(mn)
14343	19-2436	Dep.(mn)
14346	19-3114	Dep.(mn)
14370	19-2698	Dep.(mn)
14429	19-3518	Dep.(mn)
14437	19-2725	
NRL–	**(Misc.)**	
6160	19-2859	Dep.(mn); $2.00(cy), 1(mn) OTS
NRS–	**(Australian)**	
22	19-2372	Dep.(mn)
NUS–		
179	19-3726	Dep.; $6.00(cy), 5(mn) OTS
NYO–		
2541-1	19-2802	Dep.(mn); $1.00(cy), 1(mn) OTS
2906-1	19-2677	Dep.; $3.00(cy), 2(mn) OTS
2994-2	19-2803	Dep.(mn); $2.00(cy), 1(mn) OTS
3416-1	19-3487	Dep.; $3.00(cy), 3(mn) OTS
ORA–	**(Misc.)**	
03424-13-T	19-2725	See NP-14437
ORNL–		
2398	19-2449	Dep.; $3.00(cy), 2(mn) OTS
3684	19-2726	Dep.; $2.00(cy), 1(mn) OTS
3688	19-2710	Dep.; $3.00(cy), 1(mn) OTS
3700	19-1989	Dep.(mn); $5.00(cy) OTS

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3705	19-2889	Dep.; $4.00(cy), 2(mn) OTS
3713	19-3028	Dep.; $2.00(cy), 1(mn) OTS
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39	19-3288	Nucl. Phys., 61: 381-4(1965)
87	19-2577	Dep.(mn); $1.00(cy), 1(mn) OTS
95	19-2292	Inorg. Chem., 3: 1598-1600(1964)
128	19-2766	Dep.(mn); $1.00(cy), 1(mn) OTS
161	19-3328	Phys. Rev., 136: B1233-6(1964)
166	19-2727	Dep.(mn); $1.00(cy), 1(mn) OTS
169	19-3240	Dep.(mn); $1.00(cy), 1(mn) OTS
170	19-2872	Trans. Am. Nucl. Soc., 7: 422-3(1964)
177	19-3343	Phys. Rev., 136: B1348-54(1964)
192	19-2312	J. Chem. Phys., 41: 3478-83(1964)
198	19-3668	Trans. Am. Nucl. Soc., 7: 221-2(1964)
463	19-2409	Trans. Am. Nucl. Soc., 7: 446(1964)
614	19-3779	Dep.(mn); $1.00(cy), 1(mn) OTS
631	19-2860	Dep.(mn); $2.00(cy), 1(mn) OTS
635	19-2218	Dep.(mn); $1.00(cy), 1(mn) OTS
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654	19-3809	Dep.(mn); $2.00(cy), 1(mn) OTS
656	19-2079	Dep.(mn); $1.00(cy), 1(mn) OTS
657	19-2678	Dep.(mn); $2.00(cy), 1(mn) OTS
658	19-2191	Dep.(mn); $2.00(cy), 1(mn) OTS
661	19-2373	Dep.(mn); $1.00(cy), 1(mn) OTS
ORNL-TM–		
921	19-3727	Dep.(mn); $3.00(cy), 2(mn) OTS
936	19-2205	Dep.(mn); $2.00(cy), 1(mn) OTS
991	19-2890	Dep.(mn); $1.00(cy), 1(mn) OTS
ORNL-tr–		
300	19-2450	Dep.(mn); $1.00(cy), 1(mn) OTS; $1.60(fs), $0.80(mf) JCL
349	19-3456	Dep.(mn); $1.60(fs), $0.80(mf) JCL
PAN–	**(Polish)**	
515/I	19-3241	Dep.
517/I	19-3242	Dep.
518/II	19-2891	Dep.
520/IX	19-2469	Dep.
521/IX	19-2470	Dep.
527/XVII	19-2374	Dep.
533/IX-A	19-3519	Dep.
536/II	19-2274	Dep.
PATENTS	**(British)**	**3s. 6d. each, U. K. Patent Office**
968,221	19-3021	
970,368	19-2655	
970,496	19-3493	
970,589	19-3494	
970,687	19-3600	
PATENTS	**(German)**	
1,174,433	19-2656	
1,174,914	19-2567	
1,175,366	19-2657	
1,175,367	19-2658	
1,178,152	19-3446	
PATENTS	**(U. S.)**	
3,120,130	19-2588	
3,121,674	19-2417	
3,122,683	19-3796	
3,146,347	19-2589	
3,147,108	19-2743	
3,147,190	19-3601	
3,147,193	19-3602	
3,147,194	19-3603	
3,147,213	19-2418	
3,147,225	19-2206	
3,147,375	19-2590	
3,147,376	19-2591	
3,147,378	19-2592	
3,147,380	19-2593	
3,147,383	19-2508	
3,147,394	19-2659	
3,148,276	19-2660	
3,148,280	19-3475	
3,150,052	19-3584	
3,150,056	19-3604	
3,150,077	19-2419	
3,150,099	19-3605	
3,150,100	19-2355	
3,150,688	19-2509	
3,151,031	19-3495	
3,151,032	19-3496	
3,151,033	19-3497	
3,151,035	19-3606	
3,151,242	19-2550	
3,151,243	19-2934	
3,151,244	19-2529	
3,151,246	19-2551	
3,151,259	19-3447	
3,151,293	19-2594	
3,151,932	19-2460	
3,152,047	19-3585	
3,152,048	19-3586	
3,152,049	19-3607	
3,152,093	19-2356	
3,152,254	19-3022	
3,152,255	19-2661	
3,152,830	19-3498	
3,152,960	19-3499	
3,156,011	19-3817	
3,156,523	19-2461	
3,156,526	19-2462	
3,156,532	19-2706	
3,156,534	19-2357	
3,156,622	19-3448	
3,156,623	19-3449	
3,156,625	19-3709	
3,156,747	19-2791	
3,156,851	19-2595	
3,156,869	19-2662	
3,157,463	19-2463	
3,157,579	19-3500	
3,157,580	19-3608	
3,157,581	19-3797	
3,157,582	19-3501	
3,157,637	19-3818	
3,157,718	19-2792	
3,157,784	19-2596	
3,157,789	19-2663	
3,157,790	19-3228	
3,157,802	19-3023	
3,158,098	19-2597	
3,158,457	19-2510	
3,158,543	19-3502	
3,158,549	19-3609	
3,158,577	19-3803	
3,158,614	19-2464	
3,158,815	19-3819	
PATENTS	**(U.S.S.R.)**	
165,075	19-2664	
PDL–	**(Non-AEC)**	
50140	19-2728	$5.60(OTS)
PNE–		
215F	19-3810	Dep.; $1.00(cy), 1(mn) OTS
301-F	19-2556	Dep.; $3.00(cy), 2(mn) OTS
PUC–		
1964-144	19-3355	Phys. Rev., 136: B932-40(1964)
PWA–	**(Non-AEC)**	
2315	19-2514	
2319	19-3728	
2342	19-3729	
RFP–		
389	19-2578	Dep.(mn); $2.00(cy), 1(mn) OTS
439	19-2606	Dep.(mn); $1.00(cy), 1(mn) OTS
RFR–	**(Swedish)**	
239	19-3243	Dep.(mn)

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RPI–	**(Misc.)**	
328-9	19-3520	Dep.(mn); $1.00(cy), 1(mn) OTS
328-10	19-3210	Trans. Am. Nucl. Soc., 7: 262-3(1964)
328-16	19-3191	Dep.(mn); $2.00(cy), 1(mn) OTS
328-11	19-3527	Trans. Am. Nucl. Soc., 7: 211-12(1964)
RT-B10–	**(Italian)**	
(63)41	19-2160	p.47-71 of "Progresso Agricolo e Scienze Nucleari." Florence, Officine Grafiche Vallecchi, 1963.
(63)45	19-2161	p.353-61 of "Science et Technique pour les Regions peu Developpees." Rome, Consiglio Nazionale delle Ricerche, 1963.
RT-CHI–	**(Italian)**	
(64)-8	19-2729	Dep.(mn)
(64)-15	19-2220	Dep.(mn)
RTD-TDR–	**(Non-AEC)**	
63-3097	19-3148	$4.00(OTS)
SAN–		
100-1	19-2080	Dep.; $3.00(cy), 2(mn) OTS
SC-DC–		
1075	19-2665	See SC-R-64-1324
64-1559	19-2275	Dep.(mn); $1.00(cy), 1(mn) OTS
64-1573	19-2711	See SC-R-64-1355
64-1591	19-2471	$1.00(cy), 1(mn) OTS
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64-515	19-3730	Dep.; $4.00(cy), 3(mn) OTS
SLAC-PUB–		
39	19-3139	Phys. Rev., 136: B1439-51(1964)
56	19-2927	Dep.(mn); $1.00(cy), 1(mn) OTS
SRO–		
79	19-2221	Dep.; $3.00(cy), 3(mn) OTS
TID–		
20074	19-3811	Dep.(mn); $1.00(cy), 1(mn) OTS
20592	19-2294	Inorg. Chem., 3: 1642-4(1964)
20698	19-2295	Inorg. Chem., 3: 1648-50(1964)
20839	19-3087	Phys. Rev., 136: B1463-4(1964)
20848	19-2329	Phys. Rev., 136: A1397-1407(1964)
21136	19-3066	Phys. Rev., 136: B1111-19(1964)
21238	19-3521	Dep.(mn); $2.00(cy), 1(mn) OTS
21248	19-3780	Dep.(mn); $2.00(cy), 1(mn) OTS
21273	19-3654	Dep.(mn); $5.00(cy), 3(mn) OTS
21280	19-3656	Dep.(mn); $2.00(cy), 1(mn) OTS
21287	19-3812	Dep.(mn); $1.00(cy), 1(mn) OTS
21291	19-2607	Dep.(mn); $2.00(cy), 1(mn) OTS
21294	19-3454	Dep.(mn); $3.00(cy), 2(mn) OTS
21302	19-1995	Dep.(mn); $3.00(cy), 2(mn) OTS
21310	19-2892	Dep.(mn); $1.00(cy), 1(mn) OTS
21311	19-2804	Dep.(mn); $3.00(cy), 2(mn) OTS
21312	19-2805	Dep.(mn); $5.00(cy), 3(mn) OTS
21326	19-3813	Dep.(mn); $2.00(cy), 1(mn) OTS
TT–	**(Canadian)**	
64-51305	19-3816	See JPRS-27049
64-51353	19-2809	See JPRS-27097
64-51494	19-2083	See JPRS-27239
UCRL–		
7527	19-3814	Dep.(mn); $1.00(cy), 1(mn) OTS
7610	19-2579	Dep.(mn); $1.00(cy), 1(mn) OTS
7660-T	19-3399	Dep.(mn); $1.00(cy), 1(mn) OTS; Gmelin, AED-CONF-63-268-15
7663	19-2748	Dep.; $2.00(cy), 1(mn) OTS
7772	19-2981	Phys. Rev., 136: A1240-4(1964)
7776	19-2903	Phys. Rev., 136: A1614-25(1964)
7778-T	19-3033	Ann. Phys. (N. Y.), 30: 10-31(1964)
7791(Summary)	19-2548	Dep.(mn); $1.00(cy), 1(mn) OTS
7885	19-3362	Phys. Rev., 136: B1000-5(1964)
7916	19-2473	Dep.(mn); $4.00(cy), 3(mn) OTS
10843	19-3115	Dep.(mn); $4.00(cy), 2(mn) OTS
11055	19-2984	Phys. Rev., 136: B1298-1305(1964)
11086	19-2928	Dep.(mn); $1.00(cy), 1(mn) OTS
11130	19-3815	Dep.(mn); $1.00(cy), 1(mn) OTS
11186	19-3132	Phys. Rev., 136: B1137-53(1964)
11186(Rev.1)	19-3132	Phys. Rev., 136: B1137-53(1964)
11187	19-3339	Phys. Rev., 136: B1289-97(1964)
11239	19-2806	Dep.(mn); $1.00(cy), 1(mn) OTS
11470	19-2731	Dep.(mn); $2.00(cy), 1(mn) OTS
11495(Rev.)	19-3068	Phys. Rev., 136: B1154-7(1964)
11518	19-3029	Dep.(mn); $1.00(cy), 1(mn) OTS
11525	19-3088	Phys. Rev., 136: B1465-71(1964)
11545	19-3094	Phys. Rev., 136: B1525-32(1964)
11564	19-2767	Dep.(mn); $2.00(cy), 1(mn) OTS
11575	19-2276	Dep.(mn); $3.00(cy), 2(mn) OTS
11628	19-2962	Dep.(mn); $3.00(cy), 1(mn) OTS
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11641	19-3356	Phys. Rev., 136: B941-7(1964)
11671	19-2807	Dep.(mn); $2.00(cy), 1(mn) OTS
11680	19-3368	Phys. Rev. Letters, 13: 548-9(1964)
11729	19-3030	Dep.(mn); $3.00(cy), 2(mn) OTS
11730	19-3031	Dep.(mn); $1.00(cy), 1(mn) OTS
12003	19-2808	Dep.; $1.00(cy), 1(mn) OTS
12053	19-3400	Dep.(mn); $1.00(cy), 1(mn) OTS
12057-T	19-3401	Dep.(mn); $1.00(cy), 1(mn) OTS
12124-T	19-2532	Dep.(mn); $1.00(cy), 1(mn) OTS
12151	19-2608	Dep.(mn); $2.00(cy), 1(mn) OTS
13126	19-2533	Dep.(mn); $7.00(cy), 6(mn) OTS
UJV–	**(Czechoslovakian)**	
1111/64	19-3798	Dep.(mn)
1119/64	19-2375	Dep.(mn)
UR–		
875-26	19-3044	J. Phys. Soc. Japan, 19: 1507-11(1964)
875-42	19-3133	Phys. Rev., 136: B1174-5(1964)
875-45	19-2990	J. Geophys. Res., 69: 4435-9(1964)
875-46	19-3060	Phys. Rev., 136: B1053-63(1964)
875-47	19-3287	Nucl. Phys., 61: 368-80(1965)
875-48	19-3079	Phys. Rev., 136: B1345-7(1964)
USNRDL-TR–	**(Misc.)**	
730	19-3455	
784	19-2081	
WADD-TR–	**(Non-AEC)**	
61-72(Vol.X Suppl.)	19-2359	$3.00(OTS)
WCAP–	**(Misc.)**	
2056(Pt.III)	19-2515	Dep.(mn); $4.00(cy), 3(mn) OTS
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